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EDITORIAL

Mining and Agriculture.

In some parts of the world special measures have been taken and legislation enacted, with the object of ensuring that areas from which minerals have been extracted shall be left in a condition suitable for agricultural purposes. In the case of dredging for minerals, a usual manner of reconditioning the soil is to remove the top fertile layers and replace them in approximately their original position after the land has been worked. In Malaya little has been done in respect of this matter, as is evidenced by the areas of mine tailings to be found in various parts of the country. When it is realised that these mine tailings are generally worthless for agricultural purposes, not only at the present time, but are likely to remain infertile for the better part of a century, it will be seen that there is some cause for the fairly widespread opinion in Malaya that mining and agricultural interests are definitely antagonistic by reason of the above facts and also on account of the silting of the rivers.

Experience in other countries has shewn that the waste of land that has taken place in Malaya is not a necessary concomitant of the recovery of minerals from the soil by dredging. Even in Malaya there are a few instances of dredged lands that have been treated with the object of leaving a soil that can be rendered suitable for agricultural purposes. In such cases the method has been to settle a layer of "slimes" over the dredge tailings. Indications are not wanting that land so treated can be rendered suitable for the growth of a number of agricultural crops in a comparatively short time, although, apart from the experiments with padi described in an article in this issue, no definite tests can be quoted in proof of the statement. Experiments with other crops are, however, contemplated.

Ability to grow padi on dredged and slimed lands is of particular interest, as dredged land can be left in a manner specially suitable for convenient irrigation. Should it be proved that such land can be made to produce heavy crops of padi, it is not an impossible conjecture that some existing padi areas which cover tins deposits might be improved with respect to ease of irrigation by being dredged and reconditioned. In this way mining interests, in certain cases, may yet prove to be distinctly helpful, instead of antagonistic to agricultural interests.

Coconut Harvesting.

Careful investigation of each operation in the preparation of copra is being undertaken by this Department with the object of improving the colour, oil content and of the yield per acre.

The progress of this work has been published from time to time in this Journal. Readers will realise from these accounts that the investigator is unable to recommend any one method the adoption of which would revolutionise the local industry, but he has pointed the road towards better production by the observance of a number of precautions which cumulatively should bring about improvements in yield and quality which it is hoped will eventually be reflected in enhanced prices.

In an article included in this number, Mr. F. C. Cooke discusses his work on the harvesting of coconuts for copra production. A consideration of the arguments advanced by the writer points to conclusions, the more important of which are; firstly that the highest yield of oil and copra is obtained at the time of natural nut fall and secondly, that the harvesting of nuts in different stages of ripeness seriously affects the quality of copra by reason of the fact that the mixing on a kiln of unripe coconut meat with ripe and over-ripe meat results in an irregularly dried product, which means that while some of the copra will be over-dried and discoloured other pieces will be insufficiently dried and therefore open to the attack of moulds.

We have stressed the importance of effecting improvements in copra production. The planter is perhaps less concerned with this subject because he has found in practice that the buyers do not offer an enhanced price commensurate with the extra expense of producing good copra. At the risk of reiteration we would point again to the possibility that increased world production of copra on an over-stocked oil market may at any time make the home buyers more selective in the purchase of their requirements and that poor quality copra might thereby become unsaleable.

Furthermore, and to our mind a very much greater argument in favour of the adoption of better methods of harvesting and preparing copra, this research work indicates that the adoption of more scientific harvesting of coconuts and more care in the preparation of the copra tends towards higher yields of copra with consequent reduction of costs. It is perhaps on the realisation of this increase of crop that the future of the industry depends and therefore if for no other reason, we recommend the "tightening up" of the harvesting methods on coconut estates of Malaya.

Fish Culture

Following an article on the rearing of carp in ponds by Mr. W. Birtwistle, Officer-in-Charge, Fisheries Department, S.S. and F.M.S., which appeared in the August number of this Journal, the same author contributes to the present number an article giving an account of the methods employed by the Chinese in catching the carp fry in China and transporting them to Singapore.

The subject if of more than academic interest as not only is the trade considerable, but the expense involved is great on account of the very personal supervision entailed and the high mortality amongst the fry in spite of all precautions.

The author shews the possibilities of considerable economies in transport by the adoption of oxygenated water and by the employment of inexpensive apparatus which should appeal to the class of Chinese who are mainly responsible for introducing carp fry into Malaya.

Manuring of Oil Palms.

Our knowledge of the manurial requirements of the oil palm is restricted by the fact that its history as a plantation crop is very short, while it takes many years to establish a thorough knowledge of the manurial requirements of the crop.

Mr. C. D. V. Georgi contributes to this number an article on the "The Removal of Plant Nutrients in Oil Palm Cultivation" which, while not attempting to prove the manurial requirements of the crop, yet shows that a considerable amount of plant nutrients may be removed from the land by the leaves, male inflorescences, and fruit bunches of oil palms. Neglect to return to the soil all the waste organic material removed with the crop may therefore, in after years, result in very serious mineral impoverishment and entail considerable additional expense in manuring.

The reader is warned, however, that the estimation of plant nutrients removed by a crop cannot be used as a guide to manuring.

Original Articles.

RECLAIMING OLD MINING LAND FOR AGRICULTURE

BY

F. BIRKINSHAW,

Agricultural Field Officer, Perak North.

The Dredged lands of Malaya.

Dredging has become one of the most common methods of obtaining tin ore in Malaya. Up to the present no attempt has been made in this country to re-condition land so dredged by first removing the top soil and then replacing it after the land has been worked.

A very large proportion of the soil left behind by tin dredges consists of coarse particles almost totally devoid of humus, most of the fine particles and practically all the vegetable matter generally being removed in the process of dredging and washing to obtain the tin ore.

Such soil is practically worthless for agricultural purposes. It remains in this state for a considerable period and cannot be rejuvenated economically on a large scale by any known method.

It can probably be accepted that for fifty years, or even a century after being deposited, the majority of dredge tailings † in Malaya are unlikely to be converted by natural means even into a moderately good medium for plant growth.

The Mining Enactment of the Federated Malay States requires that the effluents from mines which flow into the rivers shall not contain more than 800 grains of slimes per gallon. To comply with this requirement it is generally necessary to settle out a proportion of the slimes* on land before the effluent is discharged into the rivers. Frequently, the settling out of slimes on an area set aside for the purpose is necessitated to conserve sufficient water to float and work the dredge. In some cases alum or other flocculant is used to effect settlement of slimes. Slimes usually contain very little, if any, vegetable matter.

It will be seen, therefore, that a proportion of the fine soil particles or slimes is frequently retained, but these are generally settled in one or more restricted areas and are not spread over the whole of the area worked.

A few exceptions exist where the slimes are settled more or less evenly over a large part of the worked land, either because it is convenient and economical

† Dredge tailings. In the case of tin dredging the refuse left behind after removal of the ore. Composed mainly of coarse particles. Most of the fine particles are removed in suspension in the water used to wash the soil from the ore.

* Slimes. The fine soil particles (which are removed in suspension in the water used for washing the soil from the heavy crude ore), when settled out are termed slimes.

CROP OF PADI GROWN ON RECLAIMED MINING LAND.

PLAN OF EXPERIMENTS AT KAMUNTING ON SLIMED LAND

1'-1" -6" -8" -8" -10" 1'-1" 1'-7" 1'-9" **MIMOSA INVISA** **2½ ACRES** 8" 8" 1'-0" 1'-9" 1'-1" 8" 1'-6" 1'-6" 1'-9" 1'-7" 2'-0" 1'-11"	13. CONTROL 2'1" 1'5" 2'7"	9. TEPHROSIA CANDIDA 2'8" 2'9" 3'4"	5. CROTALARIA ANAGYROIDES 2'8" 3'2" 2'6"	1. CROTALARIA USAREMOENSIS 2'4" 2'0" 2'5"
	14. CROTALARIA USAREMOENSIS 2'3" 2'6" 2'4"	10. CONTROL 2'8" 2'11" 1'6"	6. TEPHROSIA CANDIDA 1'11" 1'10" 1'10"	2. CROTALARIA ANAGYROIDES 1'3" 1'2" 1'10"
	15. CROTALARIA ANAGYROIDES 2'3" 2'9" 2'0"	11. CROTALARIA USAREMOENSIS 2'3" 3'0" 2'2"	7. CONTROL 1'6" 1'3" 11"	3. TEPHROSIA CANDIDA 1'6" 2'1" 2'5"
	16. TEPHROSIA CANDIDA 1'6" 3'2" 3'1"	12. CROTALARIA ANAGYROIDES 2'6" 1'2" 2'0"	8. CROTALARIA USAREMOENSIS 1'6" 1'5" 4"	4. CONTROL 8" 2'4" 2'5"

NUMBERED PLOTS, EACH ONE ACRE, SOWN ON AUGUST 22ND AND 24TH 1925. LARGE AREA OF 2½ ACRES SOWN WITH MIMOSA INVISA AT 6'x 6' ON DECEMBER 20TH 1926. FIGURES. OTHER THAN PLOT NUMBERS. REFER TO DEPTH OF SLIMES.

SCALE ——— = 1 CHAIN.

to do so, or because special conditions have been entered in the mining lease requiring that it be done.

The conversion of either dredge or open-cast mine tailings into a fertile soil is as yet an unsolved problem. There are reasons for supposing, however, that if these tailings are covered with a sufficiently deep layer of slimes it is possible, within a reasonable period, to convert the land into a medium that will successfully support a variety of crops. Very little definite information is available as to the optimum depth of slimes for any particular agricultural purpose, or to what extent the optimum depth may vary in accordance with the type of soil mined.

Preliminary Experiments.

In July 1922 Mr. F. H. Nash, an Officer of the Mines Department, Federated Malay States, who was at the time specially detailed for investigation in connection with dredging problems and stationed in Taiping, approached the Assistant Agricultural Inspector, Perak North, on the question of re-conditioning dredged lands and rendering them suitable for agricultural purposes.

The first step was obviously to ascertain the best and cheapest means of supplying the deficiency of humus in the slimes. The growing of green dressings suggested itself as probably the best way of providing this humus. In May, 1923, two Dredging Companies kindly agreed to provide land and facilities for experiments. One area was chosen at Kota on land that was dredged in 1917 and used as a settling area up to 1922, the slimes being about five feet in depth. Another area was selected at Kamunting which was dredged and slimed at the end of 1916. This area had been worked previously by Chinese miners over a period of about nine years i.e. between 1905 and 1914. The slimes varied in depth from 9 inches to about 2 feet. In September, 1923, a further area was selected near Batu Gajah.

It was necessary in the first place to ascertain the plants that would grow on the slimes and it was recognised that it was desirable to find a plant that could be cheaply and easily established and which would, with little or no attention thereafter, continue to make good growth or regenerate itself by self seeding.

In small scale preliminary trials the following plants were used:—(1) *Mimosa invisa* (2) *Tephrosia candida* (3) *T. purpurea* (4) *T. Hookeriana* (5) *Crotalaria striata* (6) *C. usaremoensis* (7) *Sesbania aculeata* (8) *Cajanus indicus* (9) *Centrosema Plumieri* (10) *Stizolobium niveum* and (11) *Vigna Catjang*. The heavy and recently settled slimes needed very efficient drainage to enable any of these plants to thrive. Plants were sown in clumps at various distances apart in order to ascertain the maximum distance that could be employed.

The only plants in the above list that appeared suitable for the purpose were *Mimosa invisa, Tephrosia candida, Crotalaria usaremoensis* and *C. striata*. It

was ascertained that *Mimosa invisa* would cover the land completely with a dense growth if sown in clumps at 6 feet x 6 feet. *Tephrosia candida* was slower in becoming established, but thereafter maintained a good growth. A satisfactory planting distance was found to be in clumps 4 feet x 4 feet. This plant stood pruning well; the prunings were left to rot on the ground. *C. usaremoensis* proved the more promising plant of this genus. Neither of the two species used is a perennial, but there were indications that both might successfully regenerate themselves by self seeding. None of the herbaceous twiners tried made satisfactory growth.

Main Experiments.

In August 1925 an area of four acres was fenced at Kamunting and divided into sixteen plots; twelve were sown with *Tephrosia candida, Crotalaria usaremoensis* and *C. striata* and four control plots were left unplanted. Germination of seed was poor owing to wet weather and insufficient drainage. The drainage was improved and the area was re-sown in June, 1926 and *Crotalaria striata* was replaced by *C. anagyroides,* which had proved to be more satisfactory.

In deciding upon these main trials the advantages of the comparative level surface of slimed land for padi cultivation was borne in mind and the experiments were laid down with the definite object of planting padi on the area after the green dressings had been left to grow for three or four years. The site at Kamunting was selected because it appeared that suitable water for irrigation purposes could be obtained when required. The possibility of dredging stanniferous padi areas and leaving them more suitable for this crop on account of improvement in levels also received consideration.

Mimosa invisa was not included in this experiment because it was thought that it might be costly to remove when the land was cleared and also might prove troublesome as an "escape", since seeds are spread readily by various agencies.

Observations on this plant in the small scale plots indicated, however, that *M. invisa* would probably prove the most satisfactory plant of any tried. It died down for a short period in dry weather, but regenerated itself successively in a very satisfactory manner, adding an appreciable layer of decayed vegetable matter to the soil on each occasion. Accordingly, in December 1926 an extension of 2½ acres was added to the 4 acres and on this extension *M. invisa* was sown in clumps at 6 feet x 6 feet.

Observations on Green Dressings used in the Main Experiments.

In all cases, seed was sown in clumps in hand cultivated spots, the land between not being cultivated. Weeding was carried out in the early stages and thereafter the plants received no further attention.

The following brief observations indicate the behavior of the plants :—

(a) *Mimosa invisa.* The 2½ acres on which this plant was grown included the preliminary small scale trials area; the original plants of *T. candida* that still existed were allowed to remain. In six months the Mimosa had made good growth and had already begun to spread over the area. The plant behaved as in the preliminary trials and left a fresh layer of decaying vegetable matter on the land on each occasion it died down. A strong growth of "lalang" grass appeared in places where the crop died down, but the fresh seedlings soon smothered this on the return of wet weather. No difficulty was experienced in turning this crop under when the area was being prepared for the reception of padi.

(b) *Tephrosia candida.* This plant was somewhat slow in becoming established but thereafter made steady growth, the continuous leaf fall and periodic prunings providing an appreciable addition of vegetable matter to the soil. This plant, on account of its thick woody main stem, proved costly to uproot when the area was cleared for padi.

(c) *Crotalaria usaremoensis.* This plant suffered severely from wilt and within a year most of the plants had succumbed to this disease. Thereafter only a few self-sown plants remained and the land became covered with indigenous plants, including "lalang" grass, all of which made strong growth, apparently as the result of the combined effects of the green dressing and improved drainage. *C. usaremoensis* did not suffer from wilt disease in the preliminary trials probably due to the fact that the area was more closely drained than the area occupied by the main experiments.

(d) *C. anagyroides.* This plant is very quick-growing and is taller and more robust than *C. usaremoensis.* It did not suffer from wilt and succeeded in regenerating itself to some extent so that clumps of the plant still existed when the area was cleared for padi. The indigenous vegetation grew very luxuriantly after the first sown plants of *C. anagyroides* had died.

Padi Trials.

Experiments with padi were commenced on the 6½ acres in the 1930—31 season. An encircling bund was constructed and four cross bunds made, dividing the area into four separate acres and a 2½ acre area. Each of the separate acres contained one plot of each of the three green dressings and one control plot.

The plants of *Tephrosia candida* and *Crotalaria anagyroides* were first uprooted and the hard wood disposed of at a cost of $17.50 per acre.

In February 1930 the whole area was cleared and all hard wood plants uprooted and removed at a cost of $16 per acre. This was followed by cultivation to a depth of 8 inches in April at a cost of $35 per acre which included filling in all drains and levelling up depressions. At the same time the banks of the

drain running along one side of the area were strengthered in order that it might serve as an irrigation canal and this was connected up by another canal to the source of water supply.

Initial difficulty was experienced in the efficient irrigation of the area as the slimes did not retain the water which tended to seep though to the under layer of silt. This was to some extent improved by puddling with the native hexagonal roller known as the "golek".

Four pedigree varieties of padi were sown, viz. Seraup Nos. 1, 36 and 52 and Radin 2 and in addition a little of the variety Serendah was used for a high level area on the 2½ acre section.

Sowing and planting dates were as follows :—

Variety.	Sown.	Planted.
Seraup 1.	29.7.30	20. 9.30
Seraup 36.	29.7.30	3.10.30
Seraup 52.	29.7.30	10.10.30
Radin 2.	4.9.30	13.10.30
Serendah 741.	18.9.30	23.10.30

Seraup 1 Radin 2 and Serendah were planted direct from the nurseries. Dry weather in September made it difficult to irrigate efficiently much more than one acre, so after the planting of Seraup 1, the other two Seraup varieties were transplanted in clumps near the nursery area and these were later split up for the final transplanting.

Preparation of the land was rendered difficult owing to dry weather and consequent inefficient irrigation immediately after "menajak", (cutting down of weeds) which not only delayed the rotting of the vegetation, but also allowed weeds to become re-established. A grass locally known as "Sarang Buaya" (*Ischaemum timorense*, Kunth.) proved a particularly troublesome weed through the entire first half of the season.

All padi plants made healthy growth and tillered freely and, except for persistent damage by *Nymphula depunctalis* throughout the season to plants on the outskirts of most plots, the experiment appeared to be very promising until mid-January when the presence of an unusual number of dead leaves was noticed. Examination revealed stem borer infection in 37 per cent. of the tillers.

When fruiting spikes began to appear in February it was noted that they were produced very irregularly and hopes of a good crop were abandoned.

Harvesting was commenced on March 17th. and completed on the 28th. Notwithstanding all efforts of prevention, birds which congregated in the plots in thousands, caused considerable loss of grain.

A plot of 1/40 acre was measured on the most promising area on each of the four one-acre blocks and the yields calculated therefrom were as follows :—

Seraup 1.	225 gantangs per acre
Seraup 36.	135 gantangs per acre
Seraup 52.	116 gantangs per acre
Radin	134 gantangs per acre

These measurements were not intended to serve for calculation of the all-over yield obtained, but to indicate the yield obtained on the best parts of each block where the padi had suffered least from stem borers and birds. The total padi reaped from each of the 4 one-acre blocks was :—Seraup 1, 120 gantangs; Seraup 36, 44 gantangs; Seraup 52, 52 gantangs; Radin 2, 43 gantangs.

Immediately after harvest stem borer counts were again made with the following results :—

Plants.	Tillers.	Attacked tillers.	Percentage of attack.	Caterpillars Found Schoenobius.	Diatraea.
37	1023	104	18.3	53	26

Tiller counts gave the following average for each variety :—Seraup 1, 13.4 tillers; Seraup 36, 13.4 tillers; Seraup 52, 17.3 tillers; Radin 2, 14.3 tillers.

It was found that the 2½ acres contained greater irregularity in levels than was anticipated. After harvest three more bunds were made in this area and the irrigation channel was improved and 15 small water gates were put in. It is considered that it should be possible to irrigate every part of the 6½ acres efficiently next season.

Conclusions.

These experiments have conclusively proved that padi will make very good growth on dredged land covered with from 18 inches to 2 feet of slimes if the deficiency of humus in the slimes has been to some extent replenished by means of suitable green dressings grown on the land for three or four years.

It is not yet conclusively proved that land so treated will produce heavy crops of padi, but there were decided indications that the failure to produce a good crop on Kamunting last year was entirely due to the damage done by pests, mainly stem borers. There is not sufficient data available to make an absolute statement that such is the case, but the following facts make it appear extremely probable that, but for pest and bird damage, a good crop would have been harvested. These facts are :—

(a) Healthy growth was made for the first three months after planting.

(b) The plants tillered freely and naturally.

(c) Counts proved that there was heavy stem borer infection in January—37½ per cent.

(d) Examination of 37 plants containing 1,023 tillers immediately after harvest* gave a total of 79 caterpillars in the 37 plants which is an average of more than 2 caterpillars to each plant. Of these, 53 were *Schenobius incertellus* and 26 *Diatraea auricillia.*

(e) Birds ate a considerable quantity of the ripened grain.

* Ears only were removed at harvest, the straw being left standing.

It should be stated, further, that heavy damage by birds and insect pests was not unexpected. Isolated small areas of padi are always severely attacked by birds as is also the case in large areas when a small portion ripens before the rest of the surrounding crop. The 6½ acres comprising the experimental area is surrounded by grass land which contains many plants that have been proved to be natural hosts of stem borers as well as of other padi pests. *Nymphula depunctalis* was definitely found to be constantly brought into the plot in the irrigation water and large numbers of the insect were found on grasses growing on the banks of the main water channel from which the irrigation supply for the plot is obtained. On two occasions heavy swarms of *Scotinophara coarctata* (a common pentatimid bug pest of padi, locally called, "Bena Kura" or Kuta Bruang") settled on the crop, but hand-picking and the maintenance of a sufficient supply of irrigation water prevented this pest from becoming established. As intimated earlier in this article, the same success did not attend efforts to control *Nymphula depunctalis*.

Notwithstanding the above, it cannot yet be definitely claimed that the poor production of grain was not to some extent due to the influence of the soil. This point can only be conclusively settled by further experiments.

THE HARVESTING OF COCONUTS FOR COPRA PRODUCTION IN MALAYA.

BY

F. C. Cooke,

Assistant Chemist for Copra Research.

Introduction.

All coconut planters will agree on the importance of obtaining the greatest possible yield of copra per acre of coconuts. In this paper, while the factor of copra yield has received attention, the question of oil yield also has been given prominence, since it must be remembered that the copra which yields the highest percentage of free oil on milling is now receiving the highest price from buyers in Europe.

Various reasons have from time to time been advanced to explain the difference in the percentage oil content of copra from different sources, and in the following an attempt is made to determine the effect of nut ripeness on oil content.

Hitherto the question of correct nut harvesting has received insufficient attention, work having been confined to the study of a limited number of nuts from individual palms with a consequent considerable margin of error. Further, published opinions on the subject of correct harvesting are distinctly contrary.

Unquestionably, circumstances very much govern local practice. Thus in Ceylon, where nut storage is universally practised, it is probably advisable to collect the nuts slightly under-ripe to prevent germination in storage (1). In the Malayan small-holdings a number of other reasons may be advanced to explain unripe nut collection. Thus, the land may be leased for nut collection, in which case the collector gathers every nut visible; or it may be necessary to collect the nuts early in order to anticipate theft; or the rank state of the undergrowth may make it essential to pick all nuts and on no account to allow them to fall naturally and be lost; or finally, there is the problem of nuts which lodge in the branches of the palm and of the type which sprout while still on the stalk. These factors are undoubtedly obstacles in the way of careful nut harvesting, involving the collection of only completely ripe brown nuts, preferably by natural nut fall (2) which is actually practised in Samoa, (3) and on two estates in this country.

The frequency of nut picking tours is also an important consideration, because if they are too frequent, although the germination of fallen nuts is kept to a minimum, there will be a strong tendency to include a high percentage of unripe nuts in the crop. In small-holdings practice, nut collection is generally weekly, while on estates it is carried out either once a month, every six weeks, or every two months. The usual period in Malaya is six weeks and in Ceylon two months (4) (5).

Method of Procedure.

For this investigation, two estates were selected in each of the three main coconut producing districts of this country, and the mixed crop as normally harvested and received at the kiln was graded into a range of ripeness, consisting of eight groups arbitrarily chosen. The table and illustration which accompany this article demonstrate the method of sorting which is based first on colour of husk, and secondly on diameter of haustorium (embryo) if developed in the nut. On each of the six estates the procedure was to prepare and to examine the copra obtained from 100 nuts of each of the eight classes of ripeness so that 800 nuts were examined on each estate, or a total of 4,800 nuts. The detailed results, which have been condensed and summarised in the accompanying table, were examined statistically and although some constant variations in comparative yields were naturally obtained for the same class of ripeness, when the figures for each estate were compared, the accumulated results are sufficiently significant to justify certain conclusions.

It is admitted that this nut classification, although simple, cannot be used in estate practice. Its purpose is purely experimental, so that the necessary data having been obtained, practical nut grading can be simplified to the abstract expressions under-ripe, ripe and over-ripe.

Consideration of Experimental Results.

Copra Yield (Column 5). It will be seen by reference to the accompanying Table that the yield of "dry" copra per nut steadily increased from Group 1 to Group 5, after which it gradually declined on account of embryo development. For the purpose, therefore, of obtaining maximum copra yields, harvested nuts should contain an haustorium or "apple", about one inch in diameter; such nuts contain 19 per cent. more copra than the nuts of Group 1.

In the case of very immature nuts (Group 0), large numbers of which are collected on small-holdings, it may be estimated that less than two-thirds of the optimum weight of copra is obtained per nut. It was impossible to collect sufficient of these nuts on estates, while small-holding conditions also did not permit of the organisation of experiments, so that the probable copra yield for Group 0 had to be extrapolated roughly from the figures actually recorded.

Although it is not the intention in this paper to compare average copra yields for nuts in a similar condition of ripeness on the different estates, it is interesting to note that, whereas on one estate 100 nuts in group 5 gave 63 lbs. of dry copra, on another only 43 lbs. of copra were obtained from 100 nuts in the same group.

On one estate, the yield of copra from Group 1 was exceptionally small, only 34½ lbs. being obtained per 100 nuts. Here also ripening to maximum yield was unusually prolonged to Group 6 which produced, however, the normal yield of 50 lbs. of copra per 100 nuts, i.e. 40 per cent. more copra than for Group 1.

Group No.	Classification of Nuts.		Diameter of "Apple"	Percentage oil in derived copra. (dry basis.)	Yield per 100 nuts		Number of nuts to one picul of copra. (6 per cent. of moisture)	Census of nut collection on estates. (per 100 nuts)	Percentage Under-ripe, ripe and over-ripe	
	Description of Husk.	Description of Nut.			Dry copra (lbs.)	Oil (lbs.)			5,000 nuts from estates	20,000 nuts from small-holdings
0	Green (wholly)	Immature White Shell	Nil.	—	(38)	(25.5)	(322)	—		
1	Green (wholly)	Hard light coloured shell	Nil.	65.7	43	28.2	292	6	25 per cent. under-ripe	63 per cent. under-ripe
2	Green (partially)	Hard yellow-red shell	Nil.	64.4	47	30.2	267	19		
3	Red brown	Hard red-brown shell	Nil.	63.9	49	31.3	256	32		
4	Brown	Hard brown shell	¼″	64.0	51	32.6	245	18	70 per cent. ripe	31 per cent. ripe
5	Brown	Hard brown shell	¼″ to 1″	64.4	51	32.8	246	12		
6	Brown	Hard brown shell	1″ to 2″	65.8	50	32.9	251	8		
7	Brown (sprouting)	Hard brown shell	2″ to 4″	67.0	48	32.1	261	4	5 per cent. over-ripe	6 per cent. over-ripe
8	Brown (sprouting)	Hard brown shell	4″ and over	71.2	43	30.6	292	1		

(The bracketed figures were obtained by extrapolation). One picul—133.3 lbs.

Percentage Oil Content. (Column 6) It has already been stated that the main object of this work was to explore the subject of nut ripeness with a view to increasing the percentage oil content of Malayan copra by improved nut harvesting. Analyses gave, however, most unexpected results and emphatically demonstrated that ripeness is not a factor materially affecting the percentage of oil in commercial copra.

It will be seen by reference to column 5 that although the percentage oil content steadily increases from Group 3 to Group 8, the copra from unripe nuts (Groups 1 and 2) is suprisingly high in oil. A simple calculation will demonstrate that if unripe nuts were no longer collected and if nut collection was confined only to Groups 3 to 6, the percentage oil content of the copra derived would only show a fractional increase over previous figures.

Work at present in progress points to the possibility that the solids other than fat in coconut meat are liable to slow decomposition, even without burning taking place, on the kiln during the process of drying copra, and that this instability is greatest in the case of the immature tissue of green nuts, so that in certain circumstances it is possible to increase artificially the percentage oil content by reducing the weight of solids other than fat in the copra. This involves naturally a reduction in the effective yield of copra and explains also the anomalous figure for the percentage oil content of Group 1.

The rapidly increasing percentage oil content when germination becomes advanced (Groups 7 & 8) is caused by the removal of the inner tissue of the white endosperm as the haustorium develops. An oil gradient (6) exists in the white meat and the removal of the inner surface layers containing a low percentage of oil, by bacterial or mould action, insect attack or haustorium development leaves a residue of meat which is richer in oil than was the original uncorroded meat.

On the basis of the analytical results and the census of estate collection, it may be calculated that the fresh copra produced during these experiments would give an average oil content of 64.5 per cent. This is somwehat lower than the figure for the first quality commercial product which normally yields between 65 and 66 per cent. of oil (7). The oil gradient to be found in copra probably offers an explanation of this low figure since slight tissue removal, effected in the case of the commercial product by the formation of a superficial film of mould which is produced even on dry copra, and which subsequently readily falls off as dust, would increase artificially the percentage oil content slightly above the figure for fresh copra.

Oil Yield. (Column 7) The oil yield per 100 nuts is obtained by multiplying the figures in columns 5 and 6. It is significant that, in spite of the anomalous and high percentage oil content exhibited by Group 1, the total oil development within the nuts is a steadily increasing factor from Group 1 to Group 6. If it were desired to obtain the highest oil yield per acre, nuts should be collected containing an haustorium not less than 1 inch and not exceeding 2 inches in diameter (Group 6).

Stages in the Ripening and Germination of the Coconut.

(*Reading left to right*)

Top middle : uselessly immature.
Bottom row : overgerminated.
Middle row : Nos. 2—3 : highest average copra yield per nut.
Nos. 3—4 : highest average oil yield per nut.

Nut Census. (Column 8) The nuts received at estate collecting depots were counted and a census was prepared on the same basis as the classification for the experimental work. The Agricultural Field Officers in coconut-producing districts were also asked to send in returns of nut collection on small-holdings in their sub-districts using a simpler classification as follows :—

Unripe—Green Nuts showing the least trace of green colour.

Ripe—Fully brown but unsprouted nuts.

Over-ripe—Brown Nuts with a sprout showing through the husk.

All these returns are expressed in the Table as a percentage of the total crops examined.

It will be seen that a little improvement is possible in estate nut collection while in the small-holdings an exceedingly large number of very unripe nuts (8) are included in the crop . The latter include many immature nuts which were not even allowed for in the original experimental classification (Group 0).

Loss of Copra by existing Methods of Harvesting.

An approximate idea of the average loss sustained by existing methods of harvesting may be obtained by combining the results of the nut census (Column 5) with the figures of the average copra yield per nut (Column 8), thus :—

A. *Under ideal conditions of harvesting.*

100 Ripe Brown nuts @ 0.5 lbs. dry copra per nut = 50 lbs. Yield.

B. *Estate Harvesting.*

	Nuts.		Dry copra per nut.		Yield lbs.
Unripe	6	@	0.43 lbs.	=	2.58
	19	@	0.47 lbs.	=	8.93
Ripe	32	@	0.49 lbs.	=	15.68
	18	@	0.51 lbs.	=	9.17
	12	@	0.51 lbs.	=	6.12
	8	@	0.50 lbs.	=	4.00
Overripe	4	@	0.48 lbs.	=	1.92
	1	@	0.43 lbs.	=	.43
	100 nuts yield				48.83 lbs.
Theoretical Loss					2.4 per cent.

C. *Native nut collection.*

	Nuts.		Dry copra per nut.		Yield lbs.
Unripe	63	@	0.43 lbs.	=	27.09
Ripe	31	@	0.50 lbs.	=	15.50
Overripe	6	@	0.47 lbs.	=	2.82
	100	nuts yield			45.41 lbs.
Theoretical Loss					9.2 per cent.

Thus a 1,000 acre estate producing 9 piculs of copra per acre per annum might be made to yield 9.22 piculs per acre under ideal conditions of nut collection. The extra copra produced, amounting to 220 piculs per annum, would be worth at $6.00 per picul, about $1,000 nett after allowing for the cost of extra bags, additional local transport and certain general charges.

Assuming therefore that perfect nut collection may be obtained by less frequent tours on coconut areas which are clean weeded or in low grass cover, then with the consequent increased natural nut fall, picking is also reduced to a bare minimum, the cost of nut collection should tend to be lessened and the additional profit obtainable should therefore amount at least to the $1,000 per annum stated above.

Copra Drying. The advantage of more uniform nut collection does not end with financial considerations. The indiscriminate mixing on a kiln of pieces of unripe coconut meat, containing over 60 per cent. of moisture, with ripe pieces containing 50 per cent. of moisture and over-ripe pieces with 40 per cent. of moisture or less, must result in an irregularly dried product. The under-ripe pieces are more liable to subsequent mould growth, development of a red slime during copra preparation and attack by beetles (*Carpophilus* spp.), while the over-ripe pieces can easily be over-dried and are inclined to burn.

Furthermore the copra obtainable from less ripe nuts invariably produces misshapen, testaless and wrinkled copra, while rounder, crisper and whiter copra is obtainable from ripe brown nuts.

Conclusions.

1. Ripe Malayan coconuts average 0.5 lbs. of dry copra per nut.

2. The highest yield of oil and copra is obtained in Malaya approximately at the time of natural nut fall.

3. The best nuts to collect are those which are fully brown, show no growing shoot through the husk, but when opened expose an "apple" between $\frac{1}{4}$ inch and 1 inch in diameter. This is the usual condition at natural nut fall.

4. The collection of ripe brown nuts only would result in improved yields amounting on the average estate to 2 per cent., on the average small-holdings to 9 per cent., and on bad small-holdings to 12 per cent.

5 It is not possible to improve the oil content of Malayan copra materially by more careful attention to nut collection.

6. The quality of Malayan copra woud improve if unripe and overripe nuts were excluded.

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THE REMOVAL OF PLANT NUTRIENTS IN OIL PALM CULTIVATION.

BY

C. D. V. Georgi,

Ag. Agricultural Chemist.

Introductory.

An investigation has been carried out recently regarding the composition from the point of view of nutrients of the plant material—leaves, male inflorescences and bunches of fruit—removed from oil palms under cultivation.

Collection and Analysis of Samples.

Samples of leaves, male inflorescences and bunches of fruits, which were being removed in accordance with estate practice, were collected from different estates, the particular constituent of the palm being separated into its component parts for analysis. The proportions of the components were also determined so as to enable the composition of the original constituent to be calculated, since direct sampling was impossible.

The following table shows the details of separation in each case :—

Palm Constituent.	*Components.*
Leaf	Petiole, Leaflet.
Male Inflorescence	Stem, Finger.
Fruit Bunch	Stem, Branches. Pericarp, Shell. Kernel.

As regards the analysis of the components determinations of moisture, nitrogen, phosphate and potash were made, the methods employed being based on those laid down in the Official Methods of Analysis prescribed by the British Fertilisers and Feeding Stuffs Act of 1926.

Results of Analysis.

The results of analysis of the various components and the calculated composition of the constituents of the palms are shown in Tables I, II and III. In order to make the Tables as concise as possible only the average, maximum and minimum figures are given.

In this connection it may be mentioned that the results are based on the analysis of 11 samples of leaves, 10 samples of male inflorescences and 7 samples of fruit bunches. All the material was obtained from palms between 6 and 9 years old.

In the case of the fruit well-developed bunches were selected so that the results for this constituent may be regarded as slightly above the average, since it is well-known that with young palms some of the bunches do not contain such a high proportion of fruit as those from more mature palms.

Interpretation of Results.

In order to utilise the figures given and to form some idea of the total amount of plant nutrients removed during the course of a year it is necessary to know the weights of the fresh constituents for that period. These will naturally vary considerably, being dependent, for example, on the planting distance, the age of the palms, estate practice in pruning leaves, yield of fruit.

Although no figures can be laid down, an example, based partly on records from the Experimental Plantation Serdang, has been worked out in order to afford an idea of the total amount of plant nutrients in question.

Age of palms	6—7 years old
Number per acre	56
Leaves.	
Number removed during year	30
Average weight	11 lbs.
Male Inflorescences.	
Number formed during year	10
Average weight	4 lbs.
Fruit Bunches.	
Weight harvested during year	7300 lbs.

In the case of the fruit bunches the figure has been calculated to the amount of fully developed bunches corresponding to 4000 lbs. of fresh fruit.

Combining the above amounts of fresh constituents with the results of their analysis given previously the limits of the amounts of plant nutrients removed during the year would be as shown in Table IV.

The above figures indicate therefore that for even young palms considerable amounts of plant nutrients are removed annually in the course of estate practice.

As regards palms in full bearing it is difficult to compute the corresponding amounts, since owing to the comparatively recent introduction of the oil palm as an estate crop no records exist for the weights of leaves and male inflorescences removed annually from such palms. Allowing, however, merely for the

TABLE I.

Analysis of Component Parts and Calculated Composition of Whole Leaves.

(Results expressed in parts per cent.)

Details	Nutrient	Average	Maximum	Minimum
Petiole.	Nitrogen	0.089	0.100	0.076
Proportion of leaf 73.7 per cent.	Phosphate as P_2O_5	0.022	0.038	0.017
Average moisture content 70.2 per cent.	Potash as K_2O	0.209	0.377	0.070
Leaflet.	Nitrogen	0.937	0.999	0.845
Proportion of leaf 26.3 per cent.	Phosphate as P_2O_5	0.120	0.146	0.106
Average moisture content 51.4 per cent.	Potash as K_2O	0.387	0.605	0.195
Whole Leaf. (calculated)	Nitrogen	0.312	0.336	0.278
Average moisture content	Phosphate as P_2O_5	0.048	0.066	0.040
65.5 per cent.	Potash as K_2O	0.255	0.437	0.103

TABLE II.

Analysis of Component Parts and Calculated Composition of Male Inflorescences.

(Results expressed in parts per cent.)

Details	Nutrient	Average	Maximum	Minimum
Stem.	Nitrogen	0.163	0.230	0.118
Proportion of Inflorescence 17.1 per cent.	Phosphate as P_2O_5	0.034	0.040	0.026
Average moisture content 80.1 per cent.	Potash as K_2O	0.761	1.139	0.621
Finger.	Nitrogen	0.658	0.746	0.583
Proportion of Inflorescence 82.9 per cent.	Phosphate as P_2O_5	0.204	0.256	0.167
Average moisture content 70.4 per cent.	Potash as K_2O	0.583	0.700	0.333
Inflorescence. (calculated)	Nitrogen	0.573	0.658	0.503
Average moisture content 72.1 per cent.	Phosphate as P_2O_5	0.175	0.219	0.143
	Potash as K_2O	0.613	0.775	0.382

TABLE III.

Analysis of Component Parts and Calculated Composition of Fruit Bunches.

(Results expressed in parts per cent.)

Details	Nutrient	Average	Maximum	Minimum
Stem.	Nitrogen	0.171	0.294	0.131
Proportion of bunch 36.0 per cent.	Phosphate as P_2O_5	0.063	0.094	0.052
Average moisture content 80.0 per cent.	Potash as K_2O	1.340	1.531	0.699
Branches.	Nitrogen	0.314	0.447	0.266
Proportion of bunch 9.0 per cent.	Phosphate as P_2O_5	0.099	0.158	0.072
Average moisture content 64.0 per cent.	Potash as K_2O	0.881	1.246	0.480
Pericarp.	Nitrogen	0.260	0.403	0.208
Proportion of bunch 33.0 per cent.	Phosphate as P_2O_5	0.094	0.113	0.066
Average moisture content 38.0 per cent.	Potash as K O	0.286	0.377	0.217
Shells.	Nitrogen	0.266	0.320	0.249
Proportion of bunch 17.6 per cent.	Phosphate as P_2O_5	0.045	0.059	0.028
Average moisture content 15.0 per cent.	Potash as K_2O	0.103	0.156	0.059
Kernels.	Nitrogen	0.918	1.186	0.725
Proportion of bunch 4.4 per cent.	Phosphate as P_2O_5	0.617	0.728	0.506
Average moisture content 27.0 per cent.	Potash as K_2O	0.377	0.448	0.332
Fruit Bunch. (calculated)	Nitrogen	0.263	0.388	0.215
Average moisture content 51.2 per cent.	Phosphate as P_2O_5	0.098	0.128	0.074
	Potash as K_2O	0.692	0.835	0.391

estimated increase in the annual yield of bunches to 13,500 lbs. per acre it can be calculated that the average amounts of plant nutrients removed annually per acre in the case of mature palms cannot be less than 107 lbs. of nitrogen, 26 lbs. of phosphate and 154 lbs. of potash.

TABLE IV.

Limits of Amounts of Plant Nutrients Removed per Acre per Annum.

(Palms 6—7 years old and planted 56 per acre).

Details	Nutrient	Average lbs.	Maximum lbs.	Minimum lbs.
Leaves.	Nitrogen	58	62	51
	Phosphate as P_2O_5	9	12	7
	Potash as K_2O	47	81	19
Male Inflorescences.	Nitrogen	13	15	11
	Phosphate as P_2O_5	4	5	3
	Potash as K_2O	14	17	9
Fruit Bunches.	Nitrogen	19	28	16
	Phosphate as P_2O_5	7	9	5
	Potash as K_2O	51	61	29
Total.	Nitrogen	90	105	78
	Phosphate as P_2O_5	20	26	15
	Potash as K_2O	112	159	57

Remarks and Conclusions.

With such relatively large amounts of plant nutrients involved the necessity of returning to the soil as large a proportion as possible of the actual constituents will be realised.

In the case of the leaves and male inflorescences this is achieved to some extent by laying the leaves and inflorescences between the palms and allowing them to decompose gradually, the material in some instances being turned into the soil. Although this practice undoubtedly results in a certain proportion of the phosphate and potash becoming available again for the palm it is probable that most of the nitrogen will be lost.

A similar practice may be followed in the case of the debris from the fruit bunches, the material being either returned from the collecting sheds, if the fruit is separated in the field, or from the factory, if the method of bunch sterilisation has been adopted.

Further as regards the actual fruit, the ashes from the boiler, under which it is customary to burn pericarp residue, shells and, in some cases, bunch residue may be utilised for the sake of their phosphate and potash contents by spreading the material over the ground.

Even, however, if all these measures are adopted it appears likely that the application of artificial fertilisers will be necessary if the palms are to be maintained in a healthy condition, since it is uncertain to what extent the plant nutrients in the debris are conserved in the soil and become again available for the palms.

It should be realised, however, that manures may be applied for two purposes, either to replace nutrients which are being removed by the crop, thereby maintaining the supply in the soil at a desirable level, or to increase the amount of a nutrient which may originally have been present in the soil in too small a quantity to permit of maximum growth or yield.

Chemical analysis, whether of the soil or plant, cannot be relied upon as an accurate guide to the need for either type of manuring, especially in the latter case. In so far as chemical analysis may be applied as a rough guide high content of nutrients in the plant, if combined with a low content in the soil, might indicate the need for manures supplying those nutrients, while for the second type of manuring low content in the plant, if combined with low content in the soil, may, but not necessarily does, indicate the need for addition of nutrients. Only field manurial experiments can decide this point. In this connection attention is drawn to the experiments already initiated by this Department on certain estates and to which reference has been made in this Journal, Vol. XIX, No. 2, February, 1931.

In conclusion, the writer wishes to thank the Managers of Tennamaram Estate, Batang Berjuntai; Hopeful Estate, Batang Berjuntai; Bukit Minyak Estate, Batang Berjuntai and Elmina Estate, Sungei Buloh for their kindness in providing the necessary samples for analysis. He is also indebted to Mr. Gunn Lay Teik for carrying out the analyses of the fruit bunches.

TRANSPORT OF CARP FRY FROM CHINA.

BY

W. Birtwistle,

Officer-in-Charge, Fisheries Department, S.S. & F.M.S.

The Province of Kwangtung in China appears to produce by far the greatest amount of carp fry and although no figures are available, the industry must be of considerable magnitude. Enquiries were made by the Fisheries Department, S.S. & F.M.S. through one of its Chinese Officers visiting China, who reported that the fry are collected at a village called Siow Kheng on the Siow Kheng River in Kwangtung, west of Canton. The river at that point is reported to be a very fast-flowing stream. The season for collecting the fry is March and April and they are caught in a net—more properly a bag—made of coarse ramie, known as a 'Mangko' as they are washed downstream. The bag is secured in a part of the stream where the current is swift. The mouth facing up the stream is kept open by means of two poles and thus anything which floats down is swept into the first part 'A', i.e. the bosom of the net. The bosom tapers to a small circular outlet of about 4 inches in diameter and is bounded by a plaited rattan ring. This outlet opens into a square net 'B' made of similar material but with an open top. The upper edges of the net are kept about a foot above water by uprights fixed to each corner at the junction of the four bamboo floats which surround the net on all sides. The two forward corners of the net are furnished each with a looped rope which slips over a pole driven into the ground at each corner. The net is thus secured and at the same time can move up and down with any reasonable rise or fall in the level of the river.

The mouth of the 'Mangko' is usually secured two feet below the surface of the water and catches the helpless fry as they are washed downstream through the outlet into the square net where they find a resting place. The fry are taken out from time to time, and are placed in the store ponds after rejection of undesirable kinds of fish.

Nursery Ponds.

These ponds are approximately 18 feet long and 6 feet wide and filled to a depth of 1 foot with water which enters through a bamboo pipe at one end and empties through another bamboo pipe at the other end. The ponds are dug in rows, each being divided by a bank just wide enough for a man to walk. The most convenient and available water is used, but often a small reservoir across the inlet end of the ponds is constructed with sufficient head to maintain a constant flow of water. The water falls into a pond at a lower level and when necessary is restored to the head reservoir by the familiar linked wooden irrigation paddle.

At one time the fry buyers went to Siow Kheng and shipped the fry directly they were caught to a place called Boey Khoi, 3 miles from Swatow. The fry were placed in large tubs and shipped in lighters, towed by motor boats to Canton, thence by steamer to Boey Khoi, where the fish were put into nursery ponds and reared for shipment to Singapore, Shanghai and elsewhere. It is stated, however, that nursery ponds are now being established at Siow Kheng and direct shipments are being made from that place.

The unit of measure used in the sale of fry is a saucer-like vessel 8 inches across the top and about 1½ inches deep, and the buyer is expected to dip into the mass of fry himself. It is therefore advisable for a buyer to be fairly skilful in the use of the dipper if he wishes to make the best of the deal. The journey from Siow Kheng to Canton takes approximately three days. The fry, it is stated, have only absorbed their yolk by the time Swatow is reached and no food is therefore necessary up to this point.

On arrival at Swatow they are transferred into the hulls of lighters filled with fresh water and taken to the village of Boey Khoi. Thence they are transferred, by means of baskets lined with water-proof paper, and emptied into the store ponds where they receive their first feed, a preparation of duck's egg yolk which has been boiled hard, pounded and mixed with water to a thin consistency. This food is given six times a day, three times before noon and three times after, for 10 to 12 days. They are then put on an animal diet of entomostracans, copepods, rotifers etc., which are caught by coolies in fine tow nets in the early morning before the local ponds are disturbed. This is very tedious work and necessitates the employment of a large number of coolies. The fry remain on this food for another 10 to 15 days before being sorted for shipment. They are graded for size in a simple way, viz. by enclosing a mixed sample in an inverted bell-shaped sieve made of bamboo which allows those which are not large enough to escape, and retains the others. Thus graded, they are put into ponds to await buyers. The market closes after summer and fish which are unsold by this time are retained until the following year.

The fish whilst in the nursery ponds need a great deal of attention, the greatest danger being the overheating of the water, which may happen as a result of a sudden shower during warm weather and the consequent inflow of a considerable amount of warm surface water. These store ponds are small, about 18 by 6 feet and filled to a depth of 1 to 1½ feet with water. Consequently, a relatively slight influx of warmed water will cause an increase in temperature sufficiently high to be fatal to young fish. The only method of combatting this is to transfer the fry without delay into a pond with an area of water sufficient to be unaffected by these occasional sudden changes. This is done by driving the fry down through the bamboo outfall and allowing them to fall into a large pond in which is set a fine meshed net to receive them as they fall. There they remain until a fresh and cool supply of water has been run into the nursery pond to which they are transferred.

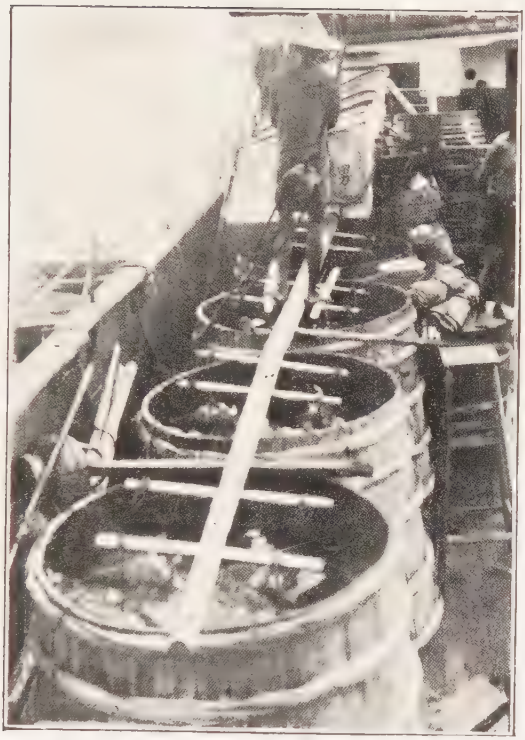
Young fry have a habit of clinging to the sides and bottom of a pond, for which reason it is extremely difficult to drive them in a given direction. To overcome this difficulty, a thick rope is dragged along the concave bottom of the pond, which, as it scrapes along, keeps the fry moving ahead of the rope as far as the outfall. Any attempt to break back over the rope can be frustrated by splashing water over the top.

The fry for Singapore are put on board at Swatow in large tubs about 6 feet high, 4 feet across the top and 5 feet at the base. They are mixed and range from 1 to 1½ inches in length and it is stated that as many as 300,000 are packed into each tub. As can be imagined the aeration of the water for such a number is not an easy task, and in fact it requires the services of four men who manage it in turns in the following way :—

The tubs are filled with water from the fry ponds and arranged in rows on the deck of the steamer. A long pole furnished with wooden cross pieces is then nailed to the centre pole and carry at each end a solid flat-faced piece of wood suspended by a cord. There are two cross pieces for each tub and therefore four pieces of suspended wood. The coolie balances himself, standing astride on the centre pole, and by shifting his weight from one foot to the other, causes the pole to rock from side to side. The suspended pieces of wood are so accurately adjusted that they will lift clear of the water when the pole is rocked in one direction but will fall with a slap on the surface of the water when rocked in the opposite direction, thus driving into the water a certain amount of air with each blow.

This rocking must continue without ceasing, day and night, sometimes for as long as 16 days. Great care must also be taken to prevent salt water finding its way into the tubs. Similarly, waste of fresh water must be avoided since ships' water is not only dear but sometimes poisonous to fish. Usually a small tub of spare pond water is carried to make up for any unavoidable losses. No food is given to the fry during the voyage since this would foul the water. Mortality is usually high and it might be said that only one half of the fish will survive a journey of about a fortnight.

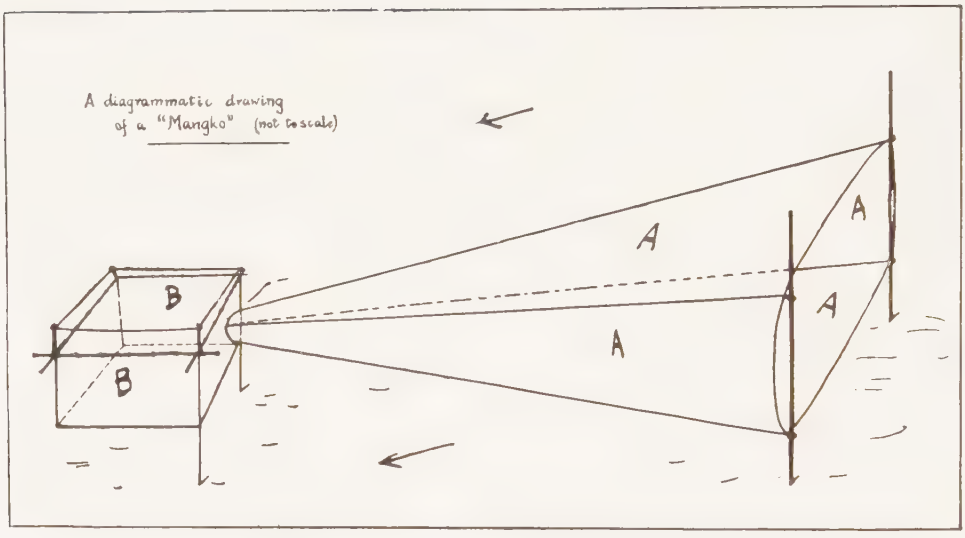
On arrival in Singapore, considerable preparations are made to receive the fish. Firstly a large lighter, carefully caulked to prevent leakage of salt water, is filled to a depth of about 1½ feet with fresh pond water and taken to the side of the steamer. The water in the tubs is carefully mixed with the new water from the lighters so that the fry may experience no great contrast of water when they are transferred in buckets and put into a coarse cloth fry net in the bottom of the lighter. They are then ferried to a waiting motor lorry and transferred to tubs for conveyance to the rearing ponds, where they will remain for three or four months before being sold. The success of these operations depends on careful handling and incessant aeration of the water. Not for one moment must this ever cease. There appears to be considerable scope for the employment of special transport cans for the fry which can be hermetically sealed and into



The rocker arrangement for aerating the water in which fry are transported from China to Singapore.

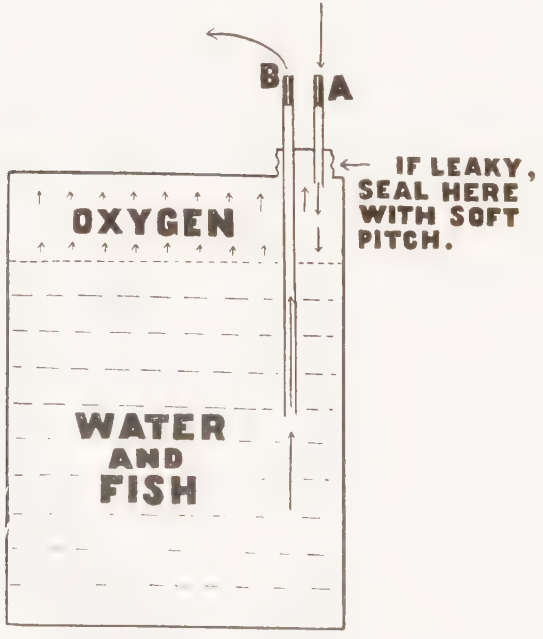
The operator is balanced and by slightly shifting his weight from side to side causes the pole to roll and lift the "droppers" out of the water one side, and to drop them on to the surface of the water on the other side. This duty must be carried on without ceasing and a stoppage would result in the total loss of all the fry.

A "CLOSE UP" OF A "DROPPER".



The "Mangko" on a bag net set to catch young carp as they are washed downstream. 'A' is the bosom of the net.

'B' is the square receiver net to hold the fry.



CONTAINER FOR TRANSPORT OF FRY.

which pure oxygen could be introduced. The employment of such receptacles for the fry would obviate the present enormous mortality and render unnecessary the considerable expense of attendants.

Experiments have shewn that 400 mixed fry 1 to 1½ inches in length can be kept for 24 hours in an ordinary 4 gallon kerosine tin with a loss of only 5 per cent. The tins should be clean and preferably new and if possible without the sealing flat which closes the outlet. The screw cap, however, must remain and be a good fit.

The screw cap is fitted with two pipes, one which reaches halfway into the tin, the other which just projects inside the tin. Each of these pipes has a length of small bore lead piping soldered to the ends which project beyond the upper part of the cap.

The tin is filled to overflowing with fish and water and oxygen is then blown through the short pipe. This displaces the water through the long pipe. Sufficient oxygen should be introduced to displace about one-fifth of the water at only a very slight pressure. The soft lead extensions should then be nipped with flat-nosed pliers to prevent the escape of oxygen, and rolled up as an extra precaution.

Care must be taken that the screw cap does not leak. It should be fitted with a soft rubber gasket. Soft pitch plastered around the outside is excellent for stopping leaks where a screw cap has been damaged or does not sit level.

Abstracts.

MALAYA AT THE PLYMOUTH GROCERS' AND BAKERS' EXHIBITION*

This exhibition was opened on March 11th, 1931 and continued until March 21st.

The Malayan Governments' Stand was devoted first and foremost to the display of Malayan canned pineapples, exhibited in a wide range of labellings and in all standard packings.

After sampling Malayan pineapples, the grocers had no hesitation in pronouncing Malayan pineapples equal in flavour, appearance and general attractiveness with the product of competing countries. The only criticisms made were (a) that too many white streaks appear, and (b) that there is sometimes a certain "woodiness" in the spiral cut slices, apparently due to the too chary removal of the core.

It was noticeable after a few days that every shop in the district was displaying Malayan pineapple prominently in its windows. A regretable feature, however, was that in some shops the so-called "G.A.Q." quality was in reality No. 2 quality.

The Exhibition was well patronised by the general public and visitors shewed quite a satisfactory interest in the Malayan fruit.

Judging by conversations with local retailers, general enquiries and the demand for booklets, it is thought that the stand performed a valuable service in the cause of general educative propaganda.

WATER-WHITE COCONUT OIL AND COCONUT FLOUR †

By cold-pressing the shredded coconut meats, which had been freed from the brown testa, a water-white oil of exceptionally high quality is obtained while a yellow oil is obtained from the parings.

The possible utilisation of the white oil cake remaining after the oil has been expelled is described. The cake was disintegrated and dried in an oven at 100°C for about 30 minutes and the crisp dry cake obtained was then ground to a coarse powder. The authors recommend that at this stage the powder should be ether extracted in order to remove as much oil as possible to prevent rancidity on keeping.‡

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* Abstract of the Report by Mr. H. S. Banner, Publicity Officer, Malayan Information Agency.

† A. O. Cruz and A. P. West. (The Philippine Journal of Science, 1930 p. 51).

‡ Nevertheless although it is known that desiccated coconut does go rancid in certain circumstances, ordinary desiccated coconut as marketed in Europe is rarely rancid, even though it may contain over 60 per cent. of oil.—F.C.C.

The redried powder is then further ground and sieved until 97 per cent. of the material passes a 20 mesh sieve. The resulting white meal when used as a flour, makes very tasty cakes, either with or without admixture of ordinary wheat flour. Furthermore, it contains about 20 per cent. of protein, a much higher proportion than is contained in wheat flour which has only about 12 per cent.

As this coconut flour makes excellent cakes and is very suitable for human consumption it is naturally more valuable than ordinary copra cake, which is merely used as cattle food.

TEA IN MALAYA.*

The estimated area planted with tea in Malaya is 1,944 acres; 701 acres of which are in Selangor, 415 acres in Pahang and 700 acres in Kedah.

Of this, 1,529 acres are estimated to be planted on lowlands and 415 acres on uplands.

In Selangor there is an appreciable area planted in tea by Chinese market gardeners. The attempt was made during the year to interest the people in improved varieties and methods of preparation.

In Kedah one large plantation of about 700 acres exists which during the year completed the erection of an up-to-date factory. Tea produced by this estate is now being sold on the local market.

Increasing interest attaches to the possibilities of cultivating upland tea in the mountainous regions in the centre of the Peninsula. Developments in this direction are being facilitated by the opening of the newly constructed road to the Cameron Highlands area in Pahang. Approximately 415 acres have already been planted in the crop and about 5,857 acres of land have been alienated mainly for this form of cultivation in these regions, while alienation of a further area of 6,080 acres has been approved. Experiments conducted by the Agricultural Department give some grounds for the belief that these regions are well adapted for the growth of the finer type of tea.

The experimental investigations both on highland and lowland tea were advanced a stage further and pluckings were made from tea areas at the Experimental Station at Cameron Highlands.

The erection of an Experimental Tea Factory at Serdang was commenced and proposals approved for the installation of tea-making machinery at Cameron Highlands.

* Abstracted from the Annual Report of the Department of Agriculture, 1930.

Miscellaneous Article.

ENTOMOLOGICAL NOTES.

Third Quarter, 1931.

BY

G. H. Corbett.

The white ant, *Coptotermes curvignathus* Holmgr., frequently referred to in entomological literature as *Coptotermes gestroi* Wasm., is familiar to most cultivators owing to the attention it pays to living rubber trees and has often been assumed to be the only species which will attack healthy plants in Malaya. Whilst this assumption is generally true, in so far that most species of white ants feed upon dead or unhealthy trees, it is not strictly accurate. During the past quarter, the writer observed soldiers and workers of the white ant, *Rhinotermes* (?) *malaccensis* Holmgr., at work at the base of an oil palm, which they had penetrated for a distance of about 3 inches and, although the leaves of this palm resembled the leaves of palms suffering from the so-called crown disease, the trunk appeared to be entirely sound.

The white ant, *Microtermes pallidus* Hav., has also been noticed damaging tea and coffee bushes in Malaya.

In this connection it may be of interest to relate that *Coptotermes curvignathus* frequently bores the trunk of coconut palms, but observations indicate that entrance is never effected through the base of the palm but always by way of the crown or directly through the bole. Where communication with the ground has become established, this has been accomplished from within the trunk and not through the base of the palm.

Oil Palm.

The caterpillars of a *Tirathaba* sp., which has been mentioned in previous entomological notes, were again received during the past quarter causing injury to the fruit bunches of the oil palm. This insect may be responsible for more damage than has hitherto been observed and the writer would be glad to receive oil palm bunches which appear to be harbouring caterpillars.

A note concerning the association between insects damaging copra and the use of old rice sacks appeared in entomological notes for last quarter. Therein it was stated that one of the principal means whereby copra became infested with insects was the employment of old rice sacks. It has come to the writer's notice that old rice sacks are also used for the transport of oil palm kernels and considerable damage to kernels by the caterpillars of the moth, *Ephestia cautella*, a pest of stored rice, was undoubtedly due to the presence of the larvae of this

moth in the sacks prior to being filled. It is suggested that old rice sacks before being filled with kernels should be steamed. This operation should not been expensive since steam is readily available in oil palm factories.

Padi.

The results of last season's work, 1930—1931, on the control of padi borers by *Trichogramma minutum* have been analysed and will be published in the near future. Mr. H. T. Pagden, Assistant Entomologist, who supervised the field work, reports that whereas egg-masses of *Diatraea auricilia* parasitised by *Trichogramma minutum* were collected earlier from the colonised than the uncolonised area, that a higher percentage of parasitised egg-masses were obtained from the colonised than from the uncolonised area and that the percentage of "bored" stems was less in the colonised than in the uncolonised area, the yield of padi from the colonised was less than that obtained from the uncolonised area. The uncolonised area was a considerable distance from the colonised area and it is thought that the yield from the uncolonised being greater than that from the colonised area was largely due to the soil being more fertile in the former than in the latter area. Arrangements are well advanced for further work in the control of stem borers by *Trichogramma minutum* in the forthcoming season 1931—1932 and especial attention will be devoted to obtain reliable and comparative yield results. For this purpose adjoining plots, half of which will receive parasites, have been so arranged to compensate as far as possible for drift of parasites.

In connection with this work, during December, 1930, January and up to February 5th., 1931, when liberations ceased, 33,500,000 eggs, an average of one half a million per diem, parasitised by *Trichogramma minutum*, for distribution over the experimental areas were sent to Parit Buntar from Kuala Lumpur.

During February, the Braconid parasite, *Microbracon hebetor* Say., appeared in the Insectary and so-reduced the colony of moths, viz : *Sitotroga cerealella* Ol., *Ephestia cautella* Walk. and *Corcyra cephalonica* St., the eggs of which are used for the propagation of *Trichogramma minutum*, that a new colony had to be built up. This has been established and up to the present *M. hebetor* has not re-appeared. Instead of fumigating the bran and rice with carbon bisulphide, which was considered to be unsatisfactory, steam was employed to render this mixture free from insects.

Enactments.

In the Agricultural Enactments and Rules, Federated Malay States, Schedule A., appear the names of plants, viz : rubber, cotton, sugar cane, coconut, coffee, bananas, tea, oil palm, which have to be certified by an Inspecting Officer that they are free from disease or pests before they are permitted to enter Malaya. This procedure is designed to prevent the introduction of an insect

or disease which may not be present in Malaya. Closely connected with the prevention of pests entering a country is the prevention of spread of those which have been introduced. In Malaya, two introductions, the giant snail and the coffee berry beetle borer, have occurred. The sources of these introductions are not known, but is it possible that the former came from Ceylon and the latter from Java. Although these introductions would be impossible to exterminate, they are not present in every part of Malaya and if care were exercised they could still be prevented from spreading from infected to uninfected areas.

The giant snail is undoubtedly spread by enthusiastic gardeners and agriculturists who distribute plants from one part of Malaya to another and at their destination, precautions are not taken to examine the wrappers, the soil or plant in order to ascertain if they harbour the eggs or snails. The giant snail is not present at the Government Experimental Plantation, Serdang, but would undoubtedly have been if prompt action had not been undertaken in examining all planting material on its arrival.

The coffee berry beetle borer is a serious pest, and to bring this insect under control, it has been found necessary to prevent the formation of berries over an extended period. Even if present in small numbers, this insect causes a considerable reduction in the yield of coffee beans. Coffee areas free from this beetle in Malaya are known and to prevent it gaining entrance to uninfected areas, further supplies of coffee seeds should not be introduced and, where new areas are to be planted, even if the seed has been certified as free, it is advisable to take the necessary precaution of immersing it in boiling water, in case this beetle in any of its stages be present. No alternative host to cultivated coffee is known, but several wild species of coffee occur in Malaya and eventually this beetle may be found to breed on wild coffee until such time as the cultivated coffee has produced berries.

Reviews.

Annual Report of the Department of Agriculture S S and F.M.S for the year 1930

31 pp. F.M.S. Government Press, Kuala Lumpur, 1931.

Brief reference was made in this Journal last month to the recently published report by Dr. H. A. Tempany, Director of Agriculture on the work of his Department during the year 1930.

The first part of the report is concerned with a survey of general agricultural conditions in Malaya during the year, and provides a review of the development of agricultural industries for this period. In this section 5 pages are devoted to rubber and give a concise statement of area, production, prices, conditions on estates and on small holdings, pests and diseases and research facilities.

It is frequently assumed that the Department of Agriculture is no longer concerned with rubber since the Rubber Research Institute of Malaya came into being. An examination of this report, however, shews that the Department is intimately concerned with the collection of statistics of areas and production, besides being responsible for all disease control work and propaganda among small holdings. The Department works in close liaison with the Rubber Research Institute, which is responsible for research work on rubber, and with the Department of Co-operation, which has undertaken work in relation to improvement of manufacturing and marketing methods among small holders.

A great deal of work was performed by the Department during 1930 in connection with the coconut industry. Some of this work, e.g. selection and cultivation experiments, has been continued for some years and important data are resulting therefrom. In addition, research on the manufacture of copra and on the causes of deterioration of copra has been carried out which may materially assist the industry in the near future. Important contributions towards our knowledge of the control of coconut pests have been made by the Entomological Division during the year.

The work of the Department on the improvement of padi varieties is well known and generally acknowledged. Work in this connection has been continued and extended by breeding investigations. The inauguration of numerous padi test plots has rendered the work of distribution of suitable strains throughout the country more effective, while research on the incidence and control of padi pests has made notable advances during the year. The control of rats in the large padi-growing areas has been continued and no less than 3,300,000 rats accounted for in the main areas of Krian and Province Wellesley. The saving of crop by these campaigns must be very considerable. The statistical work on this and other crops of importance has been reorganised and is proving a valuable factor in observing the effect of improvements attained by research and control work.

The oil palm industry has been carefully fostered by the Department. On the field side, investigations in relation to pollination, pruning, manuring, cultivation and drainage have been continued and results published from time to time, while the close investigation of the Department on the manufacturing side is recognised by the industry as is evinced by the very frequent enquiries from estates for the expert advice of the Department. The experimental oil palm factory operated by the Department is equipped to continue research on the production of improved products and on the comparison of methods of oil extraction.

The Department has continued investigation on tea production both on the lowlands and uplands of Malaya. The industry has developed and free use has been made by the public of the results obtained by the Department. The erection of tea factories at the lowland experimental area at Serdang and the upland area at Cameron Highlands respectively will enable the investigations of the Department to make considerable advances in the near future.

During the year provision was made for the inauguration of a pineapple experiment station in Singapore Island. In addition, experiments with pineapple were laid out at the Experimental Station at Serdang.

A very thorough investigation into the economic side of the industry was made during the latter half of the year. The result of this enquiry was given prominence in the last number of the *Malayan Agricultural Journal.*

In addition to the continuation of experimental work on coffee at Serdang and advisory work in connection with the pests and diseases of this crop, experiments at Cameron Highlands have shewn that Coffee Arabica can be satisfactorily grown there, and there seem to be prospects of some plantation development with this variety in that area.

Among numerous other crops which were the subject of investigation during the year may be mentioned tobacco. The Director states—

> "There seems to be no adequate reason why tobacco cultivation should not be undertaken in Malaya with fair prospects of success, with a view particularly to the reduction of imports."

The possibilities in this direction have been considered by the Department and provision for further experimental work on the crop has been made.

Attention is directed to the scope for a considerable extention in stock raising in Malaya and the work of the Department and private enterprise is summarised.

The work of the Department on the improvement of the breeds of pigs is also summarised, while it is shewn that the Department is taking practical steps to effect improvements in relation to sheep, goats and poultry.

The second part of the Director's report is concerned with a more detailed account of the activities of the Divisions of the Department. In an introductory section, attention is drawn to reorganisation proposals which comprised, *inter alia,*

schemes for the re-grading and re-distribution of duties of both European and Asiatic staff and the enlargement and extension of the field work, including a comprehensive provision of test and experiment stations throughout the country.

The buildings of the new School of Agriculture at Serdang were completed, the curriculum of the School approved, and steps taken for the recruitment of the necessary staff.

A start was made on the programme of proposals for establishment of agricultural stations and test plots throughout the country. The scheme for operating padi test plots was re-cast and standardised lines for experiments both with new selected strains of padi seed and with manures were worked out; experiments on the cultivation of padi were also begun.

Efforts were continued to extend the distribution of planting material for minor crop and fruit trees, and it was arranged that as each agricultural station came into being, plant distribution work should comprise an integral part of the work.

The activities of the Department in relation to school gardens have been maintained and extended and a gratifying improvement in work in this direction is visible.

The publications of the Department were re-organised and met with wide-spread appreciation in their new form.

The Director concludes—

> "The year has witnessed a very considerable extension of the activities of the Department and it is believed that the work done is meeting with a measure of appreciation from the public which the Department is intended to serve."

D. H. G.

The Bionomics of some Malayan Rhynchota (Hemiptera-Hetiroptera).

By N. C. E. Miller, f.e.s.

Special Bulletin, Scientific Series, No. 5, Department of Agriculture, S.S. & F.M.S., 142 pages and 123 text figures, Price one dollar (Straits Currency.)

In this publication the author has contributed detailed information regarding eighteen species of Rhynchota occurring in Malaya and described two new species, *Ochrochira rubrotincta* and *Derepteryx chinai*. Both these species were collected at Cameron Highlands (4750 ft.), the former feeding on *Citrus limonum* and the latter on *Rubus* spp.

The distribution, host plants, economic importance and notes on the life histories of all these species are given and the nymphal stages of the majority are described and illustrated. Certain external features are discussed and

methods used for rearing described. To assist the worker in the field in identifying a particular species a list of the names of plants with Malay names has been prepared. In addition, measures for the control of bugs are discussed and a bibliography of the literature cited completes the publication. The author has advanced considerably the knowledge concerning the nymphal stages of some species of Rhynchota and the publication should prove of value to entomological and agricultural workers in Malaya and elsewhere.

G. H. C.

Mineral Content of Natural Pastures.

Sixth Report of the Committee of the Economic Advisory Council.

London H. M. Stationery Office 1931 66pp. Price 1s. 0d. Net.

The Committee of Civil Research appointed a sub-committee in 1925 to consider and report on the mineral content of natural pastures. Later in that year, this sub-committee presented the first Interim Report giving the substance of the scientific results at present achieved and indicating the lines on which further information was desired. In the following year the report on a visit to South Africa and Kenya by Dr. J. S. Orr was considered from which the sub-committee decided that co-ordinated research effort in this direction was likely, within a relatively short space of time, to yield further information of practical value to the animal husbandry industry of the Empire.

The second report, which was presented in 1926, set out the facts brought out by the inquiry and recommended "that any practical investigations should be carried out in the most suitable colony or dependency with a view to ascertaining whether the nature of mineral deficiencies can be determined and the diseases due to them prevented."

The acceptance of these recommendations led to the inauguration of research work in Kenya. Dr. Orr, the Director of the Rowett Research Institute, Aberdeen, was appointed Director of the investigation and a member of the Committee.

The Report traces the progress of the investigations after the Research party took up their duties in Kenya. The details of the work are contained in subsequent reports of the Committee. The field work was completed in 1929 and an account of the whole investigation prepared by Dr. Orr in association with Mr. Alex Holm, Director of Agriculture, Kenya. This report is published in the Report under review.

A summary of the most important results is given together with the recommendations.

The mineral deficiency most generally found was sodium and to a less extent chlorine. The element which shewed the largest deficiency in certain cases was phosphorus.

The application of different fertilisers to the pastures in the most deficient area increased the yield of pasture from 25 per cent. where common salt was used to 400 per cent. when nitrogen and phosphates were used. Grazing animals shewed a marked preference for the parts which had been treated with fertilisers.

In districts where pastures were deficient in mineral, the provision of those to grazing animals was followed by a definite increase in rate of growth, and in milk production in the case of dairy cows.

It was found that the disease "Nakuruitis" was prevented from developing if the animals were allowed access to a mixture of common salt and an iron salt. If these results are confirmed in practice they will be of considerable economic importance.

D. H. G.

Journal of the Rubber Research Institute of Malaya.

Vol. 3 No. 1 August 1931. 53 pp. Price 50 cents.

This publication contains only the results of investigations carried out by members of the staff of the Institute or articles containing the results of investigation specially contributed. All abstracts and reviews of investigations carried out in relation to rubber cultivation, preparation, diseases, etc. in other rubber producing countries will be published in the *Malayan Agricultural Journal*. The present number contains five informative articles; viz. "A bacterological study of the decomposition of soil organic matter and its bearing on the question of manuring" by Dr. A. S. Corbet; "The effect of covers and clearing methods on the growth of young rubber" by A. R. Sanderson and Dr. W. B. Haines; "Standard instructions for the protection of pruned surfaces in budding operations" by A. Sharples and C. E. T. Mann; "The Heusser system of double tapping as applied to Prang Besar clones" by R. J. Chittenden; and "Further observations on planting systems for budding of tested clones" by C. E. T. Mann.

Departmental.

FROM THE DISTRICTS

The Weather.

September is reported to have been generally wet in North Kedah but the rainfall in the south of Kedah and in Province Wellesley and along the coast of Perak and Selangor was below the normal for September. This applies especially to Penang and Province Wellesley where although the weather was cloudy, very much less rain fell than usual, although it became wetter towards the end of the month. Fairly heavy precipitation occurred on the mountain range near Taiping, but elsewhere inland in Perak the rainfall would appear to have been a little below the normal for September. In Malacca and Singapore very heavy rain fell and figures are above the September average. Negri Sembilan and parts of the inland areas of Selangor would appear to have shared in this heavier rainfall.

Remarks on crops.

Rubber.—Prices for small-holders' rubber have been slightly below those for the last month, the quotations per picul and range being, smoked sheet $6 to $10; unsmoked sheet $4 to $8; scrap $2 to $5. In these quotations the higher prices regularly paid in parts of Province Wellesley have been excluded. At Butterworth the prices per picul were, smoked sheet $8.40 to $11.60, unsmoked sheet $7.50 to $9.25, scrap $4 to $5. These higher prices have heretofore been included in the quotations given.

During the month a number of holdings were selected in Johore for the investigations in connection with bark consumption on small holdings and it is proposed to select the remainder so that the first measurements throughout that State can commence on November 1st.

The area of untapped holdings in Negri Sembilan is reported to be approximately 6,000 acres. In Province Wellesley further holdings have gone out of tapping but this is, to some extent at least, due to owners being engaged on the padi crop. In Malacca where padi planting is finished, many holdings are being brought into tapping again. The position regarding Mouldy Rot control remains as reported last month.

Padi.—Planting proceeded satisfactorily in North Kedah and throughout Perak but in South Kedah and in Penang and Province Wellesley planting continued to be further delayed from insufficient water, until towards the end of the month when wetter weather prevailed. A sufficiency of irrigation water allowed planting to be satisfactorily completed in Kuala Kangsar and Upper Perak Districts. In many parts of the inland areas of Selangor the padi is beginning to flower. This very early planting, which appears to have been habitual in Selangor of late years, is not recommended, as much loss of grain

almost invariably ensues owing to harvesting taking place in rainy weather. Cultural methods in other respects are not generally so sound as those of the planters in most other parts of Malaya. In Negri Sembilan and Malacca the planted crop is making good growth. In the Kuala Pilah District of Negri Sembilan the crop is not yet planted. In both Negri Sembilan and Malacca it is thought that the planted area will exceed that put under the crop last season.

Collapse of Krian Spillway.—It has to be reported that on September 20th nine gates of the fifty-one that form the spillway of the Bukit Merah reservoir for Krian irrigation collapsed. The result is that irrigation for the whole of the Krian irrigation area is at an end for this season and it is expected that rebuilding of the spillway, which is considered to be necessary, will take a year to complete. As planting was well forward this season, it is thought that, provided the rainfall is up to average for the next three months, the present crop may not suffer unduly. Next season's Krian crop, however, will be wholly dependent upon rainfall so that prospects are not particularly hopeful, unless rainfall for the planting and growing season should be well up to the average and fairly evenly distributed through the season.

Tobacco.—In both Kedah and Province Wellesley it would seem that production has caught up with the local demand for this product, for prices have fallen considerably. Owing to the Federated Malay States and Straits Settlements import duties, the market for locally grown leaf is practically confined to the State and Settlement respectively in which the plant is grown and product prepared. The crop continues to extend in Kuala Kangsar, Kinta, Batang Padang and Lower Perak Districts of Perak. In all cases curing methods are crude and only designed to turn out a low grade product to supply a local demand for such. In Kedah the Principal Agricultural Officer is preparing a pamphlet with a view to encouraging improved harvesting and curing methods.

The prices ruling per picul for cured leaf are :—Kedah $28/-; Penang, first quality $35/-, second quality $30/- and third quality $20/- to $25/-; South Perak, $50/- to $65/-. The green leaf is sold by growers in South Perak for from $9/- to $10/- a picul.

Agricultural Stations and Padi Test Plots.

Kedah.—Planting was completed on Telok Chengai Rice Station and the Test Plots at Jitra, Langgor and Sala Kanan. At Rantau Panjang cultural operations were delayed owing to water shortage.

Province Wellesley.—At Glugor Padi Station the long-season varieties of Seraup padi have been planted and the planting of the Radin varieties commenced. A start has been made on the erection of two culverts under the main road to take off flood water. At Bukit Merah Padi Station planting of the long-season Seraup varieties was commenced at the end of the month.

Perak.—(*a*) *Agricultural Stations. Selama.* The clearing up of the "lalang" grass area has been completed and a contract for felling some trees and for general levelling of the site has been let. The erection of fencing is delayed for want of survey and exact demarcation of boundaries.

Kuala Kangsar.—The local maize hybrids were harvested but only gave a light crop. A good crop of Soya beans was harvested. A Chinese variety of tobacco which promised well has suffered from slime disease. The Virginia varieties are making much less robust growth than the local varieties. A batch of cured tobacco of the Kedah variety was sent to Headquarters for examination and report. The oranges are showing renewed vigour as the result of a dressing of stable manure applied last month. Tapioca and pepper were planted. The nursery contains very healthy seedlings of rambutan and marcots of oranges designed as stocks for budding.

(*b*) *Padi Stations and Test Plots. Talang.* Planting is nearly completed on the manurial and cultivation trial areas and the Seraup strains have been planted on the deeper areas usually reserved for them. The area for the banana manurial experiments has been demarcated and cleared.

Lenggong.—Planting is completed. Following last season's practice, only one plant has been used for each hill and this practice has also been adopted for the manurial and cultivation trial areas on Talang.

Bruas.—The Seraup varieties have been planted. Water supply has been adequate and the regulation of its flow over the Plot is satisfactory.

Bukit Gantang.—The dividing bunds have been laid down and completed and plants are ready for planting, but the operation is held up to coincide with the planting of the surrounding areas.

Kamunting.—Planting of the Seraup strains was completed and planting of the Radin varieties had commenced at the end of the month.

Selinsing.—The planting is completed. With the failure of irrigation owing to the collapse of the Bukit Merah spillway, water is not so plentiful as usual but has been sufficient for requirements up to the present.

Selangor.—Cheras Agricultural Station. The whole of the higher portion has been cultivated once and eradication of "lalang" grass has made satisfactory progress. Fence erection was commenced. The erection of buildings has been postponed pending approval of the plans by the Health Department. A contract for clearing the lower area has been arranged, the Chinese squatters having decided to move to a new area before the end of the year.

Kajang Test Plot.—The variety Nachin 27 has commenced to flower, but the Radin varieties have not yet thrown up their panicles. The plants have made fair growth in spite of a shortage of water.

Kuang Test Plot.—This plot has a somewhat ragged appearance owing to the irregularity of the plants due to pest attack, stem-borer having been somewhat prevalent. The quarters for the subordinate officer in charge are ready for occupation.

Negri Sembilan.—(*a*) *Agricultural Stations.* The fruit trees on the Seremban Station received a dressing of manure. At the Rembau Station the whole area has been sown with cover crops which are germinating satisfactorily. Contracts have been let for fencing and for making the road and boundary path. Erection of buildings is proceeding rapidly.

(*b*) *Padi Test Plot.*—Flooding of the station occurred on several occasions but did little damage to the planted padi, as the water subsided quickly.

Malacca.—Sungei Udang Agricultural Station. Most of the large stumps have now been removed. Six varieties of bananas and two high yielding clones of rubber were planted. Four varieties of coffee have been sown in the nursery. Drainage of the kapok and rubber blocks is in progress.

Pulau Gadong Padi Station.—Transplanting of the short-season pedigree lines and multiplication plots was completed early in the month. A belt of land on the adjoining Crown Land was cleared as a rat protection measure. The low-lying portion of the Station was flooded on the 22nd. owing to a sudden rise of the Ayer Hitam river but no extensive damage is anticipated as the result.

Alor Gajah Test Plot.—Plants are making very satisfactory growth and the plot presents a very pleasing appearance from the main road.

Singapore.—Pineapple Station. In the manurial trials fertilisers were applied. In the cultural trial area the plants treated with "Pabco Thermogen" have noticeably made better growth than those on other plots. In the rotation and green dressing trials, difficulty has been experienced in establishing cover crops. Experiments are in hand to ascertain how best the difficulty can be surmounted. Tobacco has made fair growth on fertilised plots, but very poor growth on the unmanured plots. Varieties of coffee, bananas and arecanut have been planted.

DEPARTMENTAL NOTES.

Mouldy Rot Control.

A deputation from the Planters' Association of Malaya consisting of the Hon'ble Mr. J. S. Arter, Chairman of the Association, Mr. L. W. Tivy and Mr. W. J. Doughty called upon the Acting Director of Agriculture (Mr. F. W. South) on 12th September, 1931, to discuss the incidence and control of Mouldy Rot Disease of rubber especially on small holdings.

The deputation contended that the disease was becoming rapidly more prevalent throughout various parts of the country and that in many cases the present methods of treatment were inadequate. They also pointed out the danger of the spread of the disease to large estates by reason of infected holdings on their boundaries.

The Acting Director stated that the position was fully recognised but that the present financial position of small-holders rendered it impracticable to insist on the same standard of control as had been maintained in the past, more especially was it impossible to require cessation of tapping for several weeks, a factor of major importance in the successful treatment of the disease. The policy of the Department was to educate rather than compel the small-holder to maintain control measures in his own interest, and to induce him to continue at least such control measures as would prevent excessive damage to the renewing bark on his trees. The position had now been reached that the small-holder in many cases could not afford to purchase a suitable disinfectant in any great quantity.

It was agreed that estate managers who were willing to do so should be advised to stock an approved fungicide for sale at cost price to owners of adjoining small holdings.

It was also agreed that special steps should be taken to obtain the fullest possible co-operation from all Administrative Officers in persuading small-holders to continue periodic painting with an approved disinfectant.

Assistance from Administrative Officers has often been obtained in the past with satisfactory results.

School of Agriculture, Malaya.

Two special short courses of instruction were given at the School of Agriculture, Malaya, during the school vacation. A ten day course of instruction was given to six Malay Co-operative Officers and from 4th. to 31st. August a course was given to 4 Assistant Penghulus from Perak.

Mr. V. Dawson, Senior Lecturer and Mr. J. S. Norman, Field Instructor and Superintendent, spent a fortnight of the school vacation in a visit to Carey Island, Port Swettenham, in order to study practical planting methods. Carey Island Estate was ideal for this purpose as it is concerned with rubber, coconuts and tea, and is so organised and self-contained by reason of its position and stage of development as to provide a demonstration of great value on estate management and routine.

The Department is indebted to the General Manager and Staff of Carey Island not only for assistance in this instance, but also for the facilities which Jugra Land and Carey Ltd. has always so readily afforded for conducting field investigations on various agricultural problems.

Bull Calves for Sale.

The Department offers for sale three pure-bred Montgomery bull calves reared on the Government Stock Farm, Serdang. Montgomery cattle is a dual breed suitable for draught and dairy purposes. For particulars apply to the Senior Assistant Agriculturist, Government Experimental Plantation, Serdang, F.M.S.

Tours of the Rural Lecture Caravan.

The Rural Lecture Caravan toured the Krian District of Perak from July 3rd. to 14th. visiting eight centres. The total attendances at the lectures and demonstrations were estimated to be over 14,000 persons.

The Caravan toured the Negri Sembilan from August 5th. to 19th., 1931, visiting twelve centres at which the usual demonstrations, lectures and films attracted large and appreciative audiences, in each case drawn from a wide radius.

In September the Caravan commenced a tour in Perak, starting from Parit and working through the Upper Perak and Kuala Kangsar Districts. In all 19 lectures and demonstrations were to be given.

Leave.

Mr. V. R. Greenstreet, Assistant Agricultural Chemist, returned from leave of absence on 3rd. September, 1931.

Statistical.

MARKET PRICES.

September, 1931.

The depreciation in value of the pound sterling has resulted in considerable activity, practically all commodities advancing in price. There are already signs of an early reaction in many directions.

Rubber.—The spot price of rubber smoked sheet equal to London standard remained steady in Singapore around 7⅛ cents per lb. until the last week of the month when the price rose to 8⅝ cents per lb. falling by the end of the month to 8⅛ cents. The average Singapore price for the month was 7.6 cents per lb. as compared with 7.3 cents in August. The average London price was 2.5d per lb. as compared with 2.4d in August.

Palm Oil.—The quotation at the end of September was £17.12.6 C.I.F. October/November shipment.

Copra.—Singapore copra prices remained steady around $3.90 per picul for "Sundried", but shared in the rise at the end of the month, touching $4.80, but sagging to a price around $4.50. The average Singapore price for this grade in September was $4.04 per picul and for "Mixed" $3.72, as compared with the average for the previous month of $4.21 and $3.91 respectively.

Copra cake was quoted for the greater part of the month at $2 per picul, the average price being $1.96 per picul.

Coconut Oil.—Our Singapore correspondent states that the average wholesale export price of coconut oil was $9 per picul for September. The slight increase in copra prices has not materially improved conditions in the oil business.

Gambier.—Block gambier appreciated by 50 cents and cube No. 1 by $1 per picul. The average Singapore prices for September were $9.75 for block and $17 per picul for cube No. 1. Corresponding prices in August were $9.56 and $17.25 respectively.

Rice.—The average wholesale price of Siam No. 2 Ordinary rice per picul in Singapore in August was $4.16 as compared with $3.50 in the previous month. The retail market price in cents per gantang of No. 2 Siam rice in August was :—Singapore 30, Penang 31, Malacca 28 as compared with 30, 25 and 27 for July, 1931. (See General Rice Summary in this issue for further notes on the rice market in Siam and French Indo-China.)

Arecanuts.—Palambang Whole improved in price owing to purchases for the Hongkong market. The average Singapore price in September was $4.09 per picul as compared with $3.47 for August. Owing to small imports, Bila Whole firmed to an average of $4.16 against $3.44 for the previous month. For other grades the average prices were as follows :—Sliced (mostly bought for the Annam market) $5.44 to $17.81; Split $4.62 to $6.25; Red Whole $7.94 to $8.40;

Kelantan Split $6.44 to $6.69—all per picul, the price within each range depending upon quality.

Coffee.—There was little demand until the end of the month when the exchange with the Dutch Indies fell to 105 guilders to $100 which caused an increase in values of coffee. Average Java Robusta prices varied from $15.31 to $16.44 per picul, the price between these limits depending upon quality. Corresponding average prices for the previous month were $14.25 to $16.70 per picul. The average price of Palambang coffee in September was $11.69 per picul as compared with $11.44 in August.

Pineapples.—For the first half of the month, the demand was small and there was little disposition amongst sellers or buyers to effect sales. Later buyers were disposed to meet advancing prices and a fair turnover was done for October/December shipment. Average prices per case for September were:—1½ lb. cubes, $3.50; 1½ lb. sliced flat, $3.27; 1½ lb. sliced tall, $3.31 as compared with $3.44, $3.28 and $3.39 respectively in August.

Tapioca.—Prices were steady until the latter part of the month, when there was a sharp rise in all grades. Average Singapore prices per picul for September were:—Flake fair, $3.41; Pearl seed, $4.47; Pearl medium, $4.49, as compared with $3.32, $4.19 and $4.42 respectively in August.

Sago.—During the first half of the month the market was dull and neglected, but later prices advanced so sharply that an early reaction is not unlikely. Pearl—Small fair averaged $4.44 for the month, compared with $4.25 per picul in August while Flour—Sarawak fair, averaged $1.82 per picul as compared with $1.75 in August.

Nutmegs and Mace.—Quotations are all marked up to nominal prices although the volume of business passing is small. Nutmegs, 110 per lb. average $20.87 per picul throughout August and September, though the nominal price towards the end of September was $24 per picul: 80's averaged $28.75 per picul in September, the nominal price latterly being $34. The average price for this grade in August was $27.37 per picul.

Siouw mace averaged $64.25 per picul in September and Amboina $44.75. August average quotations were $56.50 and $38.75 respectively.

Pepper.—The price of all grades of pepper appreciated sharply, buyers holding off at the latest prices quoted. Average Singapore prices per picul in September were:—Singapore Black $19.09; Singapore White $28.56; Muntok White $29.44. Corresponding prices in August were $18.19, $27.25 and $28.37 respectively.

Cloves.—Zanzibar cloves are quoted nominally at $50 per picul and Amboina at $60 per picul. Average prices for September are Zanzibar $44.75 and Amboina $51 per picul.

The above prices are based on London and Singapore quotations for rubber; on the Singapore Chamber of Commerce Reports published in September and on other local sources of information. Palm Oil Reports are kindly supplied

by Messrs. Lewis and Peat (Singapore) Ltd.; reports on the Singapore prices for Coffee and Arecanuts by the Lianqui Trading Company of Singapore, and a report on the coconut oil market by the Ho Hong Oil Mills, Singapore.

1 picul = 133⅓ lbs. The dollar is fixed at two shillings and four pence.

NOTE. The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

MALAYAN AGRICULTURAL EXPORTS.

First Half Year 1930 and 1931.

Product	Net Exports in Tons				
	1930	Jan. 1—July 31, 1930	Jan. 1—July 31, 1931	July 1930	July 1931
Coconut, fresh	10,478	6,051	4,721	1,085	918
Copra	102,014	46,530	47,042	6,436	5,916
Coconut oil	9,473	5,668	5,939	676	982
Palm oil	3,211	1,594	2,033	264	208
Palm Kernels	485	235	301	30	19
Pineapple, canned	57,698	39,423	41,029	5,957	6,196
Tapioca	31,195	17,944	17,272	2,325	2,863
Arecanuts	23,254	15,386	12,595	863	1,348
Tuba root	55½	—	41	3	8½

GENERAL RICE SUMMARY. *

August 1931.

Malaya.—Reports indicate that padi planting work for the new season 1931—2 is in hand in all areas.

Total foreign imports of rice into Malaya for August amounted to 67,862 tons, of which 48 per cent. went to Singapore, 24 per cent. into Penang, 8 per cent. into Malacca, 17 per cent. into the Federated Malay States and 3 per cent. into the Unfederated Malay States.

Of these imports 52 per cent. were from Siam, 40 per cent. from Burma, 7 per cent. from French Indo-China and 1 per cent. from other countries.

Total foreign exports of rice from Malaya in August 1931 were 14,480 tons, as compared with 14,345 tons in July 1931.

The net imports of foreign rice into Malaya from January to August 1931 were 361,578 tons or 32,418 tons less than for the corresponding period of 1930.

Stocks of padi and rice held by wholesale dealers and millers in the Straits Settlements and Federated Malay States at the end of July amounted to padi 12,214 tons and rice 30,054 tons. These stocks, converting padi at 62 per cent., together with estimated stocks in Johore, on estates and for retailers in the Straits Settlements and Federated Malay States amounted to a total of 51,532 tons, as compared with 46,196 tons in the previous month.

India.—Total foreign exports of milled rice during January to July 1931 were 1,411,000 tons, a decrease of 605,000 tons or 30 per cent. as compared with the corresponding period of 1930, or 14.7 per cent. decrease as compared with the corresponding period for the past six years.

Burma exports of rice and rice products (including exports to India) from January 1 to August 15, 1931, were 2,652,320 tons, as compared with 2,671,477 tons for the corresponding period of 1930, or a decrease of 19,157 tons, or 0.7 per cent.

Japan.—It is reported that bad weather during the past three weeks of July has changed the rice policy of the Japanese Government. Exports of rice are being suspended and the balance of the Government's stocks will be retained in Japan, poor crops being indicated with almost complete failure in some districts.

Siam.—Deliveries of padi at the Bangkok mills from December 1930 to July 1931 were 610,320 tons as compared with 661,099 tons for the corresponding period of the previous year, a decrease of 7.7 per cent. and a decrease of 263,747 tons or 30.1 per cent. as compared with the average of the corresponding period for the past five years.

* The following is an abstract of the General Rice Summary for August 1931, compiled from various sources by the Registrar-General of Statistics S.S.

Exports of rice from December 1930 to July 1931 were 824,116 tons, an increase of 63,854 tons or 8.3 per ecnt. as compared with the same period the previous year and a decrease of 131,624 tons or 13.8 per cent. as compared with the average of the same period of the last five years.

It is reported that since August 1st., the Siam Rice Market has experienced erratic fluctuations due to local conditions, the chief factor probably being the lateness of rains preventing padi supplies coming out of the interior in July. Padi supplies were small in July and supplies held in Bangkok were being depleted. The damage to the crops by floods in China with a resultant firmness in the Hongkong and Singapore markets caused a sudden anticipation of a demand from China and prices of rice advanced; the price of white rice increased by 2 ticals in two weeks. The anticipated demand not having eventuated, rice prices declined by a little over a tical per picul in three days. Padi prices which had risen in line with rice prices, did not decline so rapidly as rice, and supplies were held up by padi speculators, the supplies during the second half of August being much less than during the first half. Since the end of August, there has been no increased demand from China, and prices have declined again and the market is weak.

It is also reported that the surplus available for export at the end of June 1931, in Burma, Indo-China and Siam was 1,400,00; 900,000; and 1,000,000 tons respectively, a total of 3,300,000 tons as compared with 1,000,000; 500,000; and 500,000 tons respectively, a total of 2,000,000 tons at the same period of 1930.

Java, Madura and N.E.I.—At the end of July, the area harvested amounted to 7,486,654 acres, a decrease of 132,385 acres or 1.7 per cent. as compared with the same period of 1930; the area damaged to 353,174 acres, an increase of 168,682 acres or 91.4 per cent. as compared with the same period the previous year; and the area standing to 1,116,712 acres, a decrease of 10,988 acres or 1 per cent. as compared with the same period of 1930.

Imports into Java and Madura, January to July 1931, were 172,959 tons as compared with 191,354 tons in 1930; and the imports into the Outer Provinces, January to June 1931, were 169,886 tons as compared with 193,431 tons in 1930.

French Indo-China.—Entries of padi at the port of Cholon (January 1 to August 31, 1931) were 807,200 metric tons, a decrease of 143,417 metric tons as compared with the same period the previous year. Exports of rice from Saigon for the same period were 731,675 metric tons, a decrease of 115,882 metric tons or 13.7 per cent. as compared with the same period of 1930.

At the beginning of August the padi market was very excited and prices soared rapidly as certain millers and exporters had to cover their sales. Towards the end of the month it became calm and there was a sharp downward tendency in prices. The stocks at Cholon are considerable in view of the amount of business offering. Owing to the failure of certain dealers the rice market acted in sympathy with the padi market. However, the prices remained firm when

padi dropped and still remain above the parity of other markets in spite of the lack of interest by foreign buyers.

Ceylon.—Imports January to July 1931, inclusive were 252,309 tons, a decrease of 29,905 tons or 10.6 per cent. as compared with the same period the previous year, and a decrease of 21,532 tons or 7.9 per cent. as compared with the average of the same period for the last five years.

Of the total imports in 1931, 16.5 per cent. were from British India, 74.7 per cent. from Burma, 0.3 per cent. from the Straits Settlements, and 8.5 per cent. from Cochin China and Siam.

Europe.—The quantities of rice shipped from the East during 1931 were :—

A. To Europe period January 1 to August 13, 1931, 799,254 tons as compared with 559,768 tons for the same period of 1930, being an increase of 42.8 per cent.

B. To the Levant, period January 1 to July 16,1931, 34,140 tons, an increase of 19,032 tons or 126 per cent. as compared with the same period of 1930.

C. To the West Indies and America, period January 1 to June 30, 1931, 107,155 tons, an increase of 24,859 tons or 18.8 per cent. as compared with the same period of the previous year.

MALAYA RUBBER STATISTICS

TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF AUGUST, 1931, IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres (estimated) 2		Imports				Exports (including re-exports)				Stocks at end of month		
								during the month		during the year 1931		during the month		during the year 1931				
	Ports	Dealers	Estates of 100 acres and over	During the month	during the year 1931	during the month	during the year 1931	Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States	...	14,217	14,174	12,588	92,794	7,693	67,758	Nil	Nil	Nil	26	13,186	6,943	103,467	56,270	...	13,784	14,731
Johore	...	2,305	3,930	3,602	28,221	3,664	30,895	Nil	2	Nil	18	911	6,289	6,232	53,445	...	2,326	3,977
Kedah	...	411	2,347	2,266	16,671	1,027	8,311	Nil	Nil	Nil	Nil	782	2,459	5,049	20,172	...	454	2,356
Perlis	...	11	4	4	56	10	81	Nil	Nil	Nil	Nil	Nil	8	Nil	137	...	17	4
Kelantan ...	...	262	166	178	1,388	83	3,103	Nil	Nil	18	Nil	58	327	544	4,074	...	115	189
Trengganu ...	..	55	50	90	798	45	399	Nil	Nil	Nil	Nil	Nil	135	Nil	1,197	..	55	50
Total Malay States	...	17,261	20,671	18,728	139,928	12,552	110,547	Nil	2	18	44	14,937	16,161	115,232	135,295	...	16,751	21,307
STRAITS SETTLEMENTS																		
Malacca ...	...	3,209	1,448	1,421	9,822	(2) 2,584	(2) 15,900	Nil	16,203	Nil	135630	3,925	Nil	35,766	Nil	...	3,119	1,561
Province Wellesley	...	130	545	515	3,645			Nil		Nil						...	142	558
Dindings ...	...	115	121	100	760			Nil		Nil		6,864		48,583		...	114	141
Penang	2,247	5,360	9	8	60			297		5,164						730	4,822	8
Singapore ...	5,125	33,835	322	169	1,433			7,097		65,113		17,106		146,009		4,887	34,196	280
Total Straits Settlements	7,372	42,649	2,445	2,213	15,720	2,584	15,900	7,394	16,203	70,277	135,630	27,895	Nil	230,358	Nil	5,617	42,393	2,548
TOTAL MALAYA	7,372	59,910	23,113	20,941	155,648	15,106	126,447	7,394	16,205	70,295	135,674	42,832	16,161	345,590	135,295	5,617	59,144	23,855

TABLE II

DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Total
20	21	22	23	24	25	26
DRY RUBBER	10,922	32,315	4,482	3,151	914	51,784
WET RUBBER	2,862	1,881	340	224	1,412	6,719
TOTAL ...	13,784	34,196	4,822	3,375	2,326	58,503

TABLE III

FOREIGN EXPORTS

PORTS	For month	during the year 1931
Singapore ...	26,153	225284
Penang ...	11,430	79,317
Port Swettenham.	5,154	37,708
Malacca ...	95	3,281
MALAYA ...	42,832	345590

TABLE IV

THE PROPORTION OF FOREIGN EXPORTS REPRESENTING DOMESTIC PRODUCTION 4

AREA	For month	during the year 1931
Malay States ... / Straits Settlements	34,309	275003
MALAYA ...	34,309	275003

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [19A] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. The proportion of foreign exports representing Malayan domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5. The above, with certain omissions, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 22nd September, 1931.

METEOROLOGICAL SUMMARY, MALAYA, AUGUST 1931.

Locality	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes						Total		Most in a day	Number of days					Total	Daily Mean	Per cent
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation* .01 in or more.	Precipitation, .05 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor ...	89.9	72.6	81.3	95	70	83	75	84.4	85.0	4.00	101.6	1.67	9	8		1		183.55	5.92	49
Bukit Jeram, Selangor ...	88.6	73.5	81.1	93	70	82	77	85.3	86.8	2.66	67.6	1.05	8	6	1		1	202.15	6.52	53
Sitiawan, Perak ...	90.6	73.4	82.0	94	70	84	75	85.0	84.9	1.56	39.6	0.67	7	6				204.55	6.60	
Kroh, Perak ...	85.8	70.5	78.1	89	67	82	74	81.9	82.6	8.87	225.3	3.83	16	12		8		190.05	6.13	
Temerloh, Pahang ...	90.3	72.7	81.5	94	71	84	74	85.4	86.1	4.17	105.9	1.82	9	6	3	10		199.55	6.44	53
Kuala Lipis, Pahang ...	89.7	71.8	80.7	93	70	86	74	84.0	84.4	2.18	55.4	0.57	10	7	10	22	2	189.35	6.11	50
Kuala Pahang, Pahang ...	87.2	74.8	81.0	91	71	83	77	84.5	86.0	5.55	141.0	2.13	11	9	1		1	231.00	7.45	61
Mount Faber, Singapore ...	89.7	77.6	83.7	93	71	84	80	83.3	83.9	5.74	145.8	1.74	9	8				231.80	7.48	61
Butterworth, Province Wellesley ...	87.8	75.2	81.5	91	72	83	78	85.0	85.4	6.77	172.0	2.39	12	10			1	204.85	6.61	
Bukit China, Malacca ...	85.3	74.5	79.9	87	72	83	77	82.9	83.8	4.39	111.5	1.28	17	13	5			196.40	6.34	52
Kluang, Johore ...	89.0	72.3	80.7	93	69	84	75	82.7	82.9	3.53	89.7	1.69	13	10	2			196.60	6.34	52
Bukit Lalang, Mersing, Johore	89.6	72.7	81.1	92	71	85	75	82.9	82.9	7.99	203.0	2.15	12	11	4			219.25	7.07	58
Alor Star, Kedah ...	87.9	75.0	81.5	91	72	82	77	86.1	86.4	7.33	186.2	1.48	18	17	1			178.30	5.75	47
Kota Bahru, Kelantan ...	90.2	74.4	82.3	93	71	87	77	85.6	86.0	5.01	127.4	1.67	16	13	4			192.95	6.29	51
Kuala Trengganu, Trengganu	89.7	73.5	81.6	92	70	87	76	84.6	85.5	12.25	311.2	2.78	12	12	2	3		210.95	6.80	55
HILL STATIONS.																				
Cameron Highlands, Rhodendron Hill, Pahang 5120 ft. ...	73.0	59.8	66.4	78	58	65	61			1.24	31.5	0.47	9	5		3	6	186.75	6.02	49
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	73.3	57.6	65.5	76	51	69	63	71.3	70.5	1.44	36.6	0.48	13	7		4		171.00	5.52	45
Fraser's Hill, Pahang 4268 ft.	73.8	62.6	68.2	78	59	67	65	70.5	71.5	4.36	110.7	1.29	10	10	2	11	2	166.65	5.37	44

Compiled from Returns supplied by the Meteorological Branch, Malaya.